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AMERICAN DYESTUFF REPORTER

CIAL PUBLICATION
of the
PROCEEDINGS
ICAN ASSOCIATION
TEXTILE CHEMISTS
ND COLORISTS

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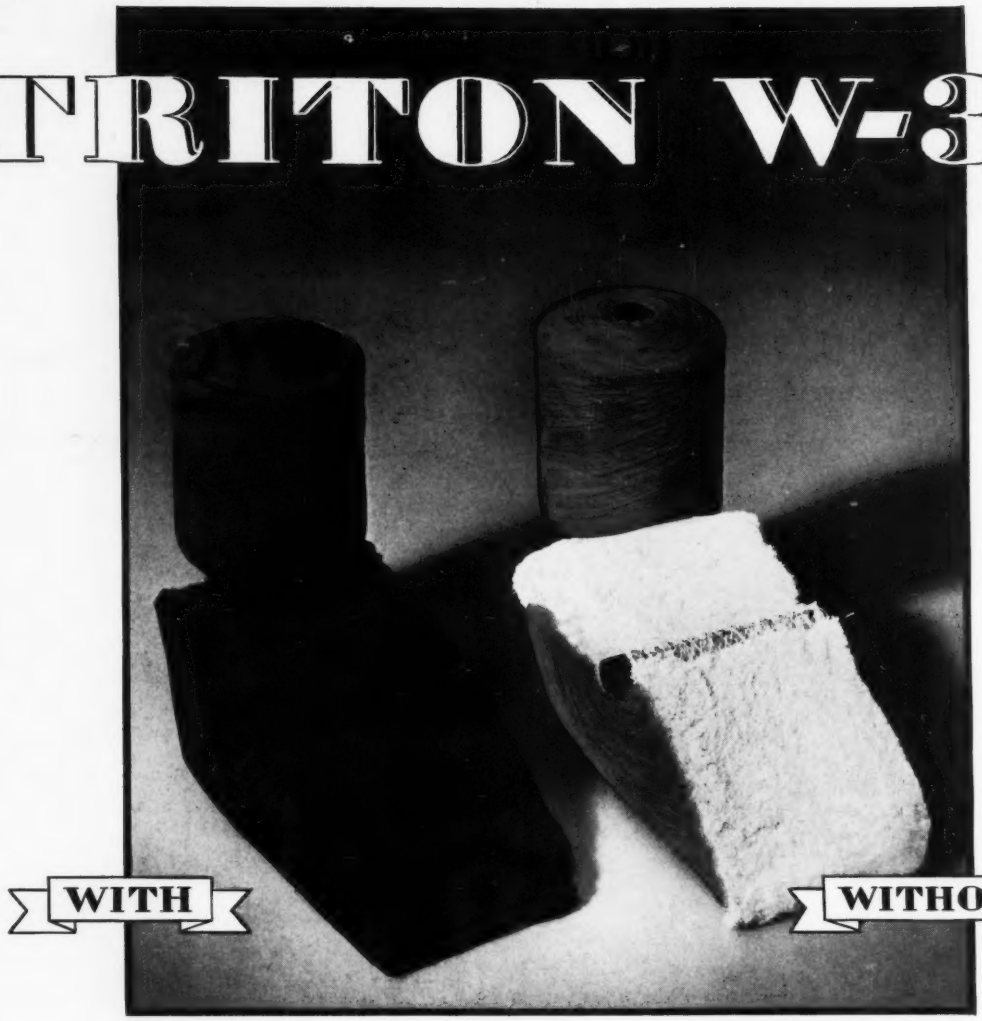

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AMERICAN
DYESTUFF REPORTER

VOLUME 29 FEBRUARY 5, 1940 NUMBER 3

Polymerization

and the Production of New Synthetics

B. A. HAROLD

THE chemical term "polymerization" has of late become a common term in textile phraseology. It is an expression which appears when the preparation of fibers is described, and the term has often been used when the application of certain finishing agents is considered.

Let us examine the definition of polymerization[1]:—"Polymerization implies the chemical change of some simple substance into another of the same percentage composition, but having a molecular weight equal to several multiples of that parent substance." The more complex compounds thus formed are termed "polymers."

The polymerization process has become a vital one because synthetic methods have come to the fore to displace natural processes and materials. When scientists attempted to simulate natural materials by synthesis, it was necessary to build organic compounds of high molecular weights—hence the polymerization process.

The avid interest in the production of synthetic materials by research workers has been encouraged by economic pressure as well as by the many disadvantageous properties of natural substances, especially their lack of uniformity. The manufacturer desires a raw material whose basic cost will not fluctuate greatly, and if it does, it should be downward. Secondly, he desires a raw material which will run uniform in physical properties from year to year. Thirdly, he continually seeks raw materials with a broader scope as regards physical properties. Unfortunately, these conditions do not hold true for many natural raw materials.

There are three industries in which synthetics with their related polymerization processes have shown a steady advance. These are the textile, rubber and plastic industries.

The field of textiles has been offered the synthetic polyamide—nylon—as well as the polyvinyl acetal polymer—Vinyon. The rubber industry has been offered broader fields for accomplishment with the introduction of the acetylene derivative—Neoprene, the butadiene derivative—Buna, and the polyalkylene sulfide derivative—Thiokol. The plastic industry, of course, has made many new applications of the numerous groups of synthetic resins such as urea formaldehyde, phenol formaldehyde, alkyd, vinyl and styrene resins.

If we study the chemistry of the steps followed to synthesize the polymers in these three distinct and separate fields, it will be found that the build-up of all have a definite and coherent relationship. For example, all of these new synthetics are substances of unusually high molecular weights when compared with natural materials. This is shown in Table I[2].

TABLE I

Compound	*Average Molecular weight*	*Number of Atoms forming chain*	*Length of chains in Angstrom Units*
Polystyrene	600,000	12,000	15,000
Polyvinyl Acetate ..	80,000	1,800	2,200
Rubber	125,000	7,200	8,100
Balata	50,000	3,000	3,400
Cellulose	120,000	3,800	3,900
Cellulose Acetate .	105,000	1,800	1,900

Mark[3] studied the close relationship which existed between different synthetic organic polymers and he concluded that the properties exhibited by any group of polymers were a cross-section of its physical structure. Mark, therefore, classified the new polymers according to the following division of their physical and chemical makeup.

(1) Chemical nature of the monomer (base compound subjected to polymerization).

(2) Average length of the main valence chains.

(3) The internal flexibility of these chains.

(4) The number of main valence linkages between the chains.

In considering the chemical nature of the organic monomer, this may be either aliphatic or aromatic. It may be either a hydrocarbon, an ester, a chloride, or a ketone,

ABOVE—Washing Neoprene Plastic Polymer in Churn

LEFT—Removing Neoprene Polymer from Mixer

RIGHT—Sheeting of Neoprene on Mill

containing one or more double bonds. Table II shows the chemical character of commonly used monomeric materials.

The average length of the main valence chains forms the background of every high polymeric substance. This depends upon the way in which the polymer has been produced, i.e., whether the polymerization was carried out at low or high temperatures, with or without a catalyst. Table III provides some idea of the number of monomers in the chain of a natural substance like rubber when compared to a true synthetic like styrene.

When considering the internal flexibility of the main valence chains, it may be said that a very long hydrocarbon chain has a certain amount of internal mobility due to the principle of free rotation around the main valence bonds. But this mobility can be reduced by substituting double bonds and ring formations within the basic structure. If Table IV is consulted, we can readily see this as those substances which show the greatest flexibility of their chains exhibit the most elastic properties.

In clarifying the effect of the number of main valences between the chains, it may be said that in many cases when the monomeric molecule contains more than one double bond, it is possible to create cross linkages between the long chains. These greatly strengthen the whole structure of the polymer or resin, making it more resistant to heat, impact and abrasion. On the other hand, the density is increased and the flowing properties decreased. This so-called "netting" of the chains may be quantitatively evaluated by a numerical figure called the "netting" index. This signifies the number of cross linkages to a hundred chain linkages. A netting number of 3 would mean that in the sample under observation, there is an average of three bonds perpendicular to the chains to one hundred parallel to them. Table V shows a rather complete range of substances both natural and synthetic together with their respective netting indices. It can be readily seen that the higher the index, the higher will be the density and toughness of the material. This is especially exemplified in the case of hard rubber, buna rubber and bakelite.

TABLE II

Chemical Class of Monomer	*Chemical formula of Monomer*	*Trade name of Polymer*
	Ethylene, $CH_2{=}CH_2$	Appanol,
	Butylene C_4H_6	Vistanex
Hydrocarbons	Butadiene C_2H_6	Buna
	Acetylene C_2H_2	S.D.O.
	Styrene $C_6H_5CH{=}CH_2$	Victron
	Isoprene C_5H_8	Natural Rubber
	Vinylacetate $C_4H_6O_2$	Vinylite
Esters	Acrylic Ester $C_4H_6O_2$	Plexigum
	Methacrylic Ester $C_5H_8O_2$	Perspex
Chloride	Vinyl Chloride C_2H_3Cl	Igelite
	Dichlorethylene $C_2H_2Cl_2$	(Koroseal)
Ketones	Methylvinyl Ketone C_4H_6O	
Alcohols	Vinyl Alcohol C_2H_4O	Vinarol, PVA

TABLE III

Data on Approximate Average Chain-Lengths

Material	*Degree of Polymerization (Number of Monomers in the Chain)*
Natural Rubber	Approx. 500-1000
Masticated Rubber	Approx. 50- 200
Low Polymerized Styrene	Approx. 50- 100
Medium Polymerized Styrene	Approx. 200- 800
High Polymerized Styrene	Approx. 2000-5000

The foregoing paragraphs may appear somewhat theoretical, yet if analyzed carefully, show a rather simple and clear picture of the makeup of the new synthetic polymers. At this point, it may be well to consider the preparation of one of the most interesting recent polymers of the textile industry—the polyamide yarn, nylon. For clarification, the term "polyamide" indicates a polymer containing a plurality of amide (NH_2,NH) linkages.

TABLE IV

Data on the Flexibility of the Chains

Material	*Internal Flexibility of the Chains*
Cellulose	Very low
Cellulose Esters	Very low
Polystyrene	Fairly low
Polyvinyl Chloride	Fairly low
Methacrylic Ester	Fairly low
Acrylic Ester	Medium
Polyvinyl Alcohol	Medium
Polyisoprene	High
Polybutadiene	Very high
Polybutylene	Very high

TABLE V

Data on Cross Linkages Between the Chains

Substance	*Amount of Cross Linkages (Netting Index)*
Native Cellulose	Nearly zero
Native Rubber	Nearly zero
Polybutylene	Very low— 3- 5
Polystyrene	Very low— 3- 5
Polyvinyl Chloride	Very low— 3- 5
Soft Rubber	Medium — 5-10
Polybutadiene	Medium — 5-10
Hard Rubber	High —10-20
Buna	High —10-20
Bakelite	Very high—50

The prime object of the original nylon patent[4] was to react together a primary or secondary diamine, such as, penta-methylenediamine with a dicarboxylic acid such as, adipic, sebacic or para-phenylene diacetic acid to form a product which could be drawn into a continuous oriented filament. This reaction unlike many of those depicting the regeneration of cellulose is basically a true synthetic one, and the original reactants are monomeric, i.e., substances of relatively low molecular weights.

The salts formed by the reaction of the various diamines and dicarboxylic acids are solid, and show little tendency towards dissociation. They are crystalline and have definite melting points. The preparation of these fiber-forming polyamide salts can be carried out as follows:

1. Fusion method—The salt may be heated in the absence of a solvent or diluent to the reaction temperature (usually 180° to 300° C.) which permits the removal of any water formed in the reaction, until examination of test portions indicate that the product has good fiber-forming qualities.
2. Another method for preparing polyamides consists in heating the salt in an inert solvent for the polymer—these may be phenol, ortho-phenol or para-phenol. When the reaction has proceeded far enough to give the polymer good fiber-forming properties, the mixture can be removed from the reaction vessel. This mixture may be used as such for spinning the filament from solution, or the polymer can be separated from the solvent by precipitation with alcohol.

Although the polyamides are fairly resistant to oxidation at the high temperatures used in their preparation, they show a strong tendency to become discolored in the presence of air. Therefore, it is desirable to exclude air during their preparation. This is done by operating in a closed vessel during the early stages of the reaction, or if in an open vessel, to provide a stream of inert gas, such as, CO_2 or H_2. In some cases anti-oxidants are added to the reaction mixture. It is also important to exclude oxygen from the polymer during spinning.

The polyamides may be spun into continuous filaments in a number of ways:

1. They can be spun directly from the reaction vessel in which they are prepared by attaching a suitable spinneret to the bottom of the vessel.
2. Wet Process—This consists in dissolving the polyamide in a suitable solvent, and extruding the resultant solution through orifices into a liquid which dissolves the solvent, but not the polyamide. The continuously formed filaments are collected on a revolving drum.
3. Dry Process—Here the solution of the polymide is extruded into a heated chamber where the solvent is removed by evaporation.
4. Melt Process—This consists of extruding the *molten* polyamide through orifices into the atmosphere where it congeals into a filament.

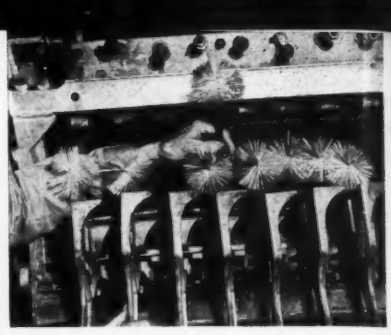
An interesting characteristic of the filaments formed is that they can accept a high degree of permanent orientation under stress. Although the unoriented filaments are pliable, soft and strong, the highly oriented filaments are far more useful. The filaments are, therefore, subjected to a cold drawing process, i.e., stretching below the melting point of the filament. By this cold drawing, the filaments can be elongated as much as 200 per cent to 700 per cent. This elongation is accompanied by an increase in tensile strength and the filaments remain permanently extended. They are much stronger and more elastic than the material from which they are made. X-ray studies of the filaments show a sharp diffraction fiber pattern. The evidence of fiber orientation shows that the cold drawn filaments are true fibers.

It may be well to point out the difference between the properties of low molecular weight polyamides (molecular weight 1,000 to 4,000) and the true fiber-forming polyamides (molecular weight 7,000 or over). The former exhibit lower melting points and possess higher solubility than the latter. The high molecular polymers dissolve more slowly and are preceded by distinct swelling. However, the most important distinction between the two types is that the high polymers are readily spun into strong, continuous, pliable and permanently oriented fibers—a property which the low polymers lack.

Nylon has not been the only true synthetic fiber which has been developed domestically, inasmuch as another

Battery of metal canisters containing nylon chips, about to be transformed into yarn. They are called "blenders" and mix the material to a uniform product.

Nylon yarn being processed. These machines twist the bundle of slender filaments for ease in handling.



A scene in the plant of a large bottling company where brushes with nylon bristles are used for cleaning bottles.

purely synthetic fiber of American development, Vinyon, is present on the market. The latter is a co-polymer of polyvinyl acetal, which is a true thermo-plastic softening at elevated temperatures. The unique properties (5) claimed for Vinyon are high tensile strength, both wet and dry, high true elasticity, resistance to attack by chemicals or fungi, water resistance and non-support of combustion.

Another purely synthetic fiber or thread derived from isobutylene has been developed[10] which is similar in chemical structure to the synthetic resin called "Vistanex."

The isobutylene fiber is produced by dissolving isobutylene in hexane solvent and forcing the solution through a spinneret into a vessel containing boron fluoride dissolved in methyl or isopropyl alcohol. The latter is maintained at low temperatures and at pressures ranging from 50 to 300 atmospheres. The precipitated fiber is given an alkaline wash, dried and then coated with talc.

In producing isobutylene threads, diameters ranging from .005″ to .050″ may be produced. These may be covered with other threads such as cotton, wool or rayon, and then spun and woven. Fabrics produced with these synthetic fibers are especially suitable for foundation garments and extensible linings for hats.

Woven elastic fabrics made from isobutylene are claimed to be odorless when compared with natural rubber, and possess superior properties as regards resistance to oxidation at higher temperatures, as well as the acid and alkaline conditions that may be encountered in laundering, dyeing and dry cleaning.

Interest by research workers has turned towards producing a fiber which will resemble wool as closely as possible in physical and chemical properties, from an abundant domestic raw material. Wool has been one commodity whose production domestically is not great enough to supply our needs. Corn, soya bean and milk have been the basic commodities which have offered the greatest possibilities as sources for abundant proteins from which fibers may be made. The polymerization process is an important stage in the production of fibers from corn. We will consider this process in the following paragraphs.

The base compound of corn which serves as a starting point for the protein fiber is called zein. This is obtained from the gluten meal, which is a by-product in the refining process of corn for the production of various starches, dextrines and sugars.

The first stage[6] in the process for obtaining the pure zein is to extract the gluten meal with aqueous alcohol, and subsequently to extract any oil and coloring matter present with toluol. When this has been carried out the composition of the remaining mass is:

	Parts by Weight
Zein	35
Alcohol	50
Water	5
Toluol	10

Water is slowly added to this mixture while agitating, and this precipitates the zein as a doughy mass. The supernatant liquid is then drawn off, and the dough that is left is transferred to a rubber mixing mill from whence it is sheeted into 1/32″ thick sheets. The sheets are soaked in water at 20° C. over night, placed on a screen to drain, and finally placed on drying racks to dry at 25° C. for two days. The dried sheets are then ground to 20 mesh size. The zein fibers are made from the ground stock as follows[7]:—

A definite amount of formaldehyde is added to a solution of zein in alchool or carbitol. This amount is equivalent to 2 per cent to 5 per cent of free formaldehyde based on the weight of the original zein used. This operation must be accurate to give satisfactory strength and water resistance to the final fibers. Plasticizers such as dibutyl tartrate or mono-butyl pthalate ranging in concentrations of 10 per cent to 20 per cent on the weight of the zein are added to the zein solution for softness and flexibility.

The resultant solution is extruded through a spinneret, the apparatus used being much the same as that used for producing cellulose acetate. Thusly, the solution may be either extruded into air, the filaments forming upon evaporation of the solvent, or the fibers may be coagulated by a liquid coagulant.

After the filaments have solidified and before they are wound, it is necessary to partially polymerize these in order to obtain satisfactory strength. This is effected in a vertical tower through which the heated air is passed counter-current to the travel of the filament. The temperature of the chamber is kept at 60° to 90° C., five

minutes at this temperature being sufficient to yield proper strength in the fibers. Higher temperatures than 90° C. cannot be used as decomposition of the protein will occur. To add a maximum of strength and water resistance to the fibers, it is necessary to subject them to a final polymerization at 60° to 90° C. for a period of 8-10 hours while they are in yarn form.

The above process may be altered by dispersing the zein in a solvent containing plasticizers, and precipitating the filaments in a formaldehyde solution, or extruding them in a gaseous medium like formaldehyde vapors.

One main advantage claimed for the zein process is that it does not require any ripening process, as in the viscose process, and hence is economical. The protein fibers have good uniformity and although they are not claimed to be an improvement over wool, their inventors have stated that the fibers have improved strength and water resistance over the present rayons.

The production of a protein fiber from casein has been the basis for investigation by the U. S. Department of Agriculture, with the result that a fibre of this nature has been produced domestically by Whittier and Gould[8].

Briefly, this process consists of dispersing casein and a fat acid (as those obtained from linseed oil) in an aqueous or alcoholic solution of an alkaline material like sodium hydroxide or sodium phosphate. An amphoteric compound like sodium aluminate is added, and this acts in two ways,—(1) as an additional solvent due to its alkalinity and (2) as a strengthening agent for the subsequently precipitated fiber. The aluminum at this point is very compatible with the solution, and no insoluble aluminum salts are liable to form.

The mixture is then forced through a spinneret into a bath of acid reaction containing formaldehyde and a dehydrating agent such as glucose or calcium chloride. In this operation, the aluminum is converted into its positive form in the precipitated fiber. This unites the casein and fat acids into a homogenous fiber, while forming insoluble aluminum salts of casein and fat acids. Thusly, the aluminum acts as a strengthening and water resisting agent. The fat acid tends to soften and adds flexibility to the fibers, while increasing their water repellency and resistance to moth attack.

The major portion of work done on the chemical structure of casein fibers has come from Europe. Casein as that obtained from milk is an abundant raw material there, unlike in our own country where we have the choice of the utilization of casein from milk, or the profuse proteins that may be obtained from the soya bean.

Essentially the foreign method for producing casein fibers is not unlike that of Whittier and Gould. The acid casein is made either by precipitating it from milk with a mineral acid or by allowing the milk to sour. The dried casein is made into a solution with a dilute caustic alkali, and the solution coagulated through a spinneret into a coagulating bath of formaldehyde and aluminum.

Chemically, casein has a striking similarity to wool, the main difference being in the low sulfur content of the casein. Both are phospho-proteins built up from a number of amino acids, analytical results showing that casein possesses a high proportion of glutamic and lysine residues in its composition. It is interesting to note that casein fiber has a specific gravity of 1.26 against 1.30 for wool, while its percentage of moisture regain is similar to wool.

In describing the chemical structure of casein fibers, Diamond and Wormell[9] have stated that unlike wool, there can be no possibility of the formation of disulfide bonds. Any cross linkages possible in casein fibers are:—

1. Salt links.
2. Methylene bonds.
3. Aluminum bridges.

The methylene group is analogous to the cystine link of wool. Thusly, if a thread of casein fiber is kept under tension in hot water for a time, it loses its tendency to contract. This may be explained by the supposition that new methylene cross links can be formed after hydrolysis under strain of the older bonds. Just as the cystine link in wool is removed by hot alkali, so do the methylene bonds of casein fiber hydrolyze upon continued boiling, especially in dilute solutions of strong acids. It is, therefore, readily understandable why casein fibers should be dyed at lower temperatures.

Diamond and Wormell found that casein fibers in fabrics felted to a greater extent than certain wool fabrics, whether the felting medium was acid or alkaline. This is interesting as casein fibers contain no scales nor disulfide linkages. These investigators attributed this marked tendency towards felting to the superficial hydrolysis of the formaldehyde from the surface layers of the fibers, which led to a gel-like surface in the same way that some research workers have attributed the felting properties of wool, i.e., to the change in plasticity of its cuticle layer.

In the foregoing we have attempted to outline a brief description of the polymerization process, and its role in the synthesis of new industrial and consumer products, particularly nylon. Heretofore, the majority of so-called artificial fibers have been produced by regenerative processes. However, the future of high grade fibers which will probably displace a good portion of the natural fibers appears to lie in their production as true synthetics by the polymerization of simple monomeric materials.

Acknowledgment

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An Interesting Chapter in

Vat Dye Progress

A. J. HALL, B.Sc., F.I.C., F.T.I.

TWO years after the close of the last war there appeared a patented procedure by which certain vat dyes could be converted into water-soluble compounds suitable for application to both animal and vegetable fibers and such that the textile material could then be treated so that these absorbed compounds could be immediately decomposed with regeneration of the original water-insoluble form of the vat. At that time no one could fail to see that this discovery marked the beginning of a new epoch in vat dyeing for it allowed considerable simplification in dyeing and made also possible a wider use of vat dyes. These anticipations have come true although somewhat more slowly than at first thought, the delay being mainly due to the higher costs involved.

The dyestuffs mentioned in this article are referred to under their foreign names. As far as we know there is only one vat dye esterified or solubilized in the United States and that by the General Aniline Works under license from abroad, this color is sold by the

Carbic Color & Chemical Company as Indigosol Green I B A.

E. I. du Pont de Nemours Co., as Ponsol Jade Green Soluble.

General Dyestuff Corporation as Algosol Green I B W.

The first patents referred more particularly to indigoid vat dyes but subsequently it was found that anthraquinone vat dyes were also amenable to the same conversion treatments. Thus two new series of dyes have been developed—the Indigosols and the Soledons. German ingenuity is behind the Indigosols and British research behind the Soledons and both series of dyes are now of the utmost importance to modern vat dyers.

It may be recalled that the first vat dye to become of prime importance was indigo, and following the determination of the chemical constitution of this dye it became possible to make synthetically numerous others of similar constitution. In this manner a range of so-called indigoid vat dyes was created, all these dyes being capable of application to vegetable and to some extent to animal fibers by a somewhat complicated dyeing process. Subsequently, about 1900 discovery was made of an entirely new class of vat dyes from a parent substance known as anthraquinone. These new dyes became known as anthraquinone vat dyes and were applicable to vegetable and animal fibers by much the same methods as the indigoid vat dyes but their application demanded a much more alkaline dye liquor so that their use for animal fibers was strictly limited. On the whole, the anthraquinone vat dyes are much faster to all influences than the indigoid type.

Both of these types of vat dye are in their ordinary fully oxidized form completely insoluble in water and thus in this state not suitable for dyeing. But by treatment with a reducing agent, generally sodium hydrosulfite, the dye is changed to a leuco form which is soluble in an alkaline liquor (caustic soda is required in the case of an anthraquinone vat dye but a weaker alkali may be used for most indigoid vat dyes) and the solution so obtained can then be used for dyeing. Afterwards the textile material can be treated with an oxidizing liquor and the original water-insoluble form of the dye produced, the dye particles thus fixed within the fibers being in a form highly resistant to washing out by detergent liquors.

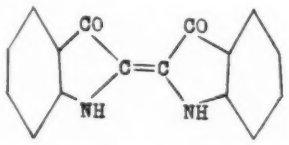
It is evident that vat dye application by these methods is somewhat more complicated than is generally desired; it is certainly much more difficult than the dyeing of cotton with direct dyes. The availability of Indigosol and Soledon dyes affords welcome relief. These dyes are simply dissolved in water, applied to the yarn or fabric by padding or by much the same easy method of dyeing cotton with direct dyes or wool with acid dyes, and the textile material than treated with an acid oxidizing liquor whereby the plain water-insoluble vat dye is reformed within the fibers so as to have the resistance to washing equal to that which results when the vat dye itself is applied by the older methods.

During the past twenty years the Indigosol and Soledon ranges have been steadily enlarged so that the whole of the spectrum is now covered. But during this period of development certain difficulties have been encountered particularly as regards the application of dye mixtures and the regeneration (usually referred to as development) of these dyes on the fiber. These difficulties arise mainly on account of the fact that the various dyes have individual characteristics which make it difficult to apply a general (average) treatment to a mixture of dyes. However, various successful expedients have been discovered to overcome these difficulties. This phase of development is of more interest to dyers and printers than is the actual production of the dyes and will be emphasized in this article.

In the first place it will be necessary to make brief reference to the methods of producing Indigosol and Soledon dyes and to their chemical constitution since this will suitably prepare the ground for dealing with the progress made in their application.

E. P. 186,057 describes the first discovery of the Indigosol type of dye. Such dyes are referred to as the enolic ethereal salts of vat dyes made by reacting acids with the hydroxyl groups of the leuco (reduced) form of the dye; the reaction is usually carried out with chlorsulfonic acid in the presence of a tertiary base as diluent. Thus Indigosol DH is the water-soluble ethereal salt of indigo itself and is made by the following reaction: 17.6 parts of chlorsulfonic acid ($ClSO_3H$) are added with cooling to 72 parts of pyridine (the tertiary base) and to this mixture is then added 12½ parts of dry dihydro-indigo (the leuco form of indigo). After stirring the mixture cold for a short time and then raising the temperature to 50 to 60° C. and maintaining it at this temperature for one hour, the product is diluted to five times its volume with water. Then, after heating, the hot mixture is filtered and on cooling the pyridine salt of the now water-soluble dye crystallizes out. Subsequently this is converted into the sodium salt which is very freely soluble in water and is the essential constituent of the Indigosol dye as sold to dyers.

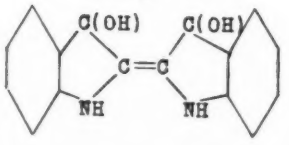
The changes to the indigo produced in the above reaction are as follows:



I

Indigo (Fully oxidized water insoluble form)

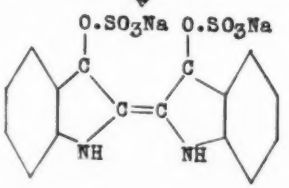
Reduction



II

Dihydro-indigo (Reduced alkali soluble form as in ordinary indigo dye liquor)

Chlorsulfonic acid + pyridine



III

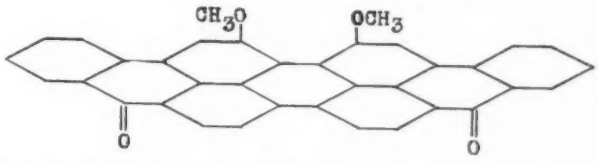
Indigosol DH (Water soluble sodium salt)

When applied to cotton or other fiber and treated with an acid-oxidizing liquor III rapidly reverts to I.

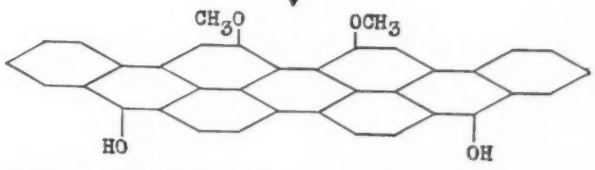
The Soledons are prepared by somewhat similar methods except that reduction of the vat dye and its conversion into the sulfuric acid ester are effected simultaneously, there being present a metal powder in the reaction mixture for this purpose of reduction.

The following is an example (E. P. 247,787) of the method as showing how the well known anthraquinone vat dye Caledon Jade Green is made into a water-soluble form.

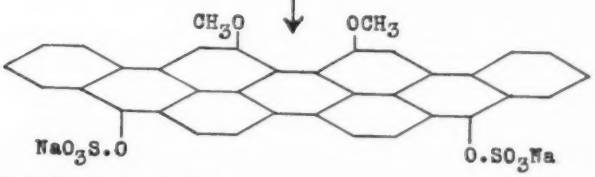
Two parts of Caledon Jade Green (dimethyoxydibenzanthrone) are suspended in 30 parts of pyridine and 6 parts of zinc dust are added. The mixture is refluxed at the boil for 10 minutes. After cooling, there is added very slowly 10 parts of methyl sulfuric acid chloride ($CH_3O.SO_2Cl$) and in this operation much heat is developed. On pouring the resulting reddish brown paste into 500 parts of water a product is obtained which consists of a dark red precipitate and a bright red liquor in which most of the pyridine is dissolved. By filtering there is obtained a residue which is the Soledon form of the dye and it simply requires purification and conversion into its sodium salt. This dye is able to color all fibers and after application to them the original Caledon Jade Green dye may be rapidly reformed by treatment with a mild acid oxidizing liquor, for example, an acidified solution of ferric chloride. The following reactions take place in the method of manufacture outlined above:



Caledon Jade Green (Fully oxidized insoluble form)



Caledon Jade Green (Reduced leuco form)



Soledon Jade Green

In applying Indigosol and Soledon dyes to cotton and animal fibers, particularly cotton and wool, the following general methods are adopted; it is to be remembered

that both types of dyes have only a moderate substantive affinity for the vegetable fibers so that in general they are most satisfactorily applied to cotton by padding. Thus cotton will be impregnated with solution of the dye containing sodium nitrite, then dried, and led through a bath containing sulfuric acid; under these circumstances nitrous acid is developed and this has sufficient oxidizing action to cause rapid reformation of indigo. To some extent, Soledon dyes have an affinity for cotton resembling that of direct dyes so that padding can be replaced by a simple dyeing operation using salt in the bath to assist exhaustion of the dye.

In the case of wool, the dye is treated as an acid dye and is applied from a boiling bath with the gradual addition of sulfuric acid to promote exhaustion of the dye. Development of the dyeing is then effected in a fresh bath with the aid of sodium nitrite (or sodium bichromate) and sulfuric acid.

Printing processes in which Indigosol and Soledon dyes are used employ much the same technique. The fabric is printed with a thickened paste containing the dye and an oxidant (sodium chlorate, sodium bichromate, and sodium nitrite), and after drying it is then passed through a bath of dilute sulfuric acid to develop the color by decomposition of the water-soluble form of the dye. In some printing processes such as those where steaming of the printed fabric is necessary for the development of other types of dyes printed adjacent and simultaneously, it is convenient to ensure that the development of the Indigosol or Soledon dye takes place in the steaming and so that an after development with acid can be avoided. In such cases the printing paste contains in addition to the dye an oxidant (preparations specially sold by the dye makers are often used) and a catalyst such as ammonium vanadate or copper salt.

As described above, these dyeing and printing processes appear to be simple, and indeed they would be so in actual large scale practice if all the dyes were alike as regards their solubility, stability, and ease of oxidation. But it is found unfortunately that the individual members differ widely in these properties. One important aspect of these differences is the difficulty involved in securing satisfactory development of color by oxidation. It may happen that if a shade obtained with the aid of two dyes is led through a developing (acid-oxidant) bath for development of the color then while one of the dyes may be oxidized just sufficient for its full reversion to the fully oxidized insoluble vat dye, the other dye may pass through this stage earlier and then suffer a certain degree of decomposition. Such over-oxidation not only leads to the development of poor shades but also to a definite loss of color value. In other circumstances, if the oxidation is carried out so that the second dye is just satisfactorily oxidized then the first dye will have been insufficiently developed. Insufficient development is harmful not only because of loss of color value but also because development will continue slowly during after-storage of the fabric with consequent change of shade. There has thus always been a demand since the first use of these dyes for some method of development which will allow such a degree of latitude that easily and difficultly oxidizable dyes can be satisfactorily developed together in the same treatment yet both dyes be protected from excessive oxidation. It is evident that these difficulties are accentuated when more than two dyes are used to produce the same compound shade.

The Indigosol dye derived from the fast Indanthrene Blue RS (N-dihydro-1:2:2′:1′-anthraquinone-azine) is an instance of a dye which is susceptible to over-oxidation so that it gives a much duller greener blue than normally.

It will now be interesting to review the various expedients which have been devised to overcome this peculiar difficulty of the development process.

E. P. 313,407 refers particularly to the dyeing of wool, and it describes how copper sulfocyanide can be used in the development to facilitate satisfactory development of a mixture of Indigosol dyes on wool materials. Before dealing with this method in detail, it may be remarked that both copper salts and sulfocyanides have been previously specified for use separately but not together. Thus according to E. P. 293,890 the development of an Indigosol dyeing by treating it with a hot acid solution of a cupric salt is described—the copper has the effect of promoting oxidation. E. P. 310,478 also describes how Indigosol dyed fabric can be developed by impregnating it with a solution of a copper salt and drying at a high temperature. It seems, however, that these processes are not suitable for wool since the copper salt does not have sufficient oxidizing power in the presence of this fiber.

The development of Indigosol dyes during the steaming of printed fabrics has already been mentioned, and E. P. 218,649 indicates that the presence of ammonium sulfocyanide (this can be conveniently added to the printing paste) assists development by reason of the acid which it liberates in steaming.

If in the development there is present a mixture of a copper salt and a sulfocyanide then it can be assumed that double decomposition takes place and copper sulfocyanide is formed. According to E. P. 313,407 this substance acts as a suitable oxidant since, even when there is excess present, over-oxidation of easily oxidized Indigosol dyes does not take place. Moreover, this special oxidant is capable of developing shades on wool; it can, of course, be equally usefully employed for the dyeing of cotton. The following method of dyeing is recommended:

Wool is first dyed at 95° C. for about ¾ hour in a bath containing the Indigosol dye (say, 1 per cent on the weight of wool) together with 1 per cent of ammonium sulfocyanide, 10 per cent of ammonium sulfate, and any suitable protective colloid such as sulfite-cellulose waste liquor.

When the bath is exhausted of dye it is cooled to 30° C. and an addition made of 5 per cent of copper sulfate and 10 grams per liter of sulfuric acid. The wool is worked in

(Continued on page 68)

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

FEBRUARY 5, 1940

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North Carolina State College Student Section

W. L. Carter, Chairman; Seymour Schandler, Secretary

Philadelphia Textile School Student Section

Bernard Menin, Chairman; Ruth Chartener, Secretary

Members should notify the **Secretary** immediately of all address changes

• CALENDAR • OF COMING EVENTS

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., March 1, 1940.

Meeting, Philadelphia Section, Penn A. C., March 8, 1940.

Annual Meeting, Mid-West Section, Sherman Hotel, Chicago, Ill., February 10, 1940.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary or the American Dyestuff Reporter any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

IMPORTANT NOTICE
To Prospective Employers

Complete personal histories and employment records of the following applicants are now on file at the office of the American Dyestuff Reporter and with the secretary of the Association. These may be examined by prospective employers or copies will be loaned upon application.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer; New York Viciniy. Age 33; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 37; married.

A-B-9

Education—Bradford Durfee Textile School, 1918, chemistry and dyeing course.

Experience—Dye application, textile and color chemist; good general factory, laboratory and office experience; accustomed to assuming responsibility; handled all types of help; purchased chemicals, dyes, etc.; executive ability; good personality.

Age 42; American, married; will go anywhere for interesting work; references.

A-B-10

Education—1 year of textile chemistry, day course, Philadelphia Textile School; also business course.

Experience—3 years as apprentice in weaving mill in Germany, office and stock room, general clerical work, practice in all departments of cotton manufacture, dyeing, bleaching and finishing of cotton-rayon mixtures, piece and package processing; several mos. in laboratory of German dyestuff manufacturer, dyestuffs and assistants and their application, vat and naphthol dyeing.

Age 20; will go anywhere in U. S.

A-B-11

Education: Graduate chemist. Correspond and converse German, some French.

Experience: 3 years dyer; 4 years dyestuff testing, trouble-shooting, purchasing; 4 years demonstrating, consulting, and supervising for large dyestuff manufacturer. Thoroughly experienced on rayon, cotton, silk, acetates, printing, vats. Fullest references as to character and ability. Seeks position as technician, consultant, or superintendent with reliable dyestuff sales organization or dyehouse. Age 33, married.

A-B-12

Education—Philadelphia Textile School (Evening), Chemistry and Dyeing, Quantitative and Qualitative Analysis.

Experience—Two years in yarn office, making wool stock blends. Last 6 years in dyehouse, 4 years as kettle hand, 2 years in piece dye work. Worked on yarn, raw stock and piece goods; has been dyer on union piece goods, cotton, rayon and wool, leaving wool white; also worked on all wool fabrics and woolen cross dyes; also considerable laboratory experience doing laboratory dyeings and extraction work. Seeks position as dyer or laboratory technician.

Age 30; married; references.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-8

Education—B.T.C., 1933, Lowell Textile Institute.

Experience—5 months as rayon slasher tender; 8 months color matching, dye testing and analytical work; 5 years with large print works in rayon finishing department, laboratory, color matching, dye testing, assistant rayon dyer. Seeks position as rayon dyer, assistant dyer, or any job in a rayon dyeing and finishing plant. Age 29; single.

A-B-C-9

Education—Lowell Textile Institute; chemistry, dyeing and textile finishing.

Experience—Twelve years head dyer in hosiery mills. Dyeing all types of fibers and in combination. Knowledge of all dye applications. Matching and formula making. Charge of every department in a hosiery mill except fixing machinery. Has done jigg work on cottons and rayons. Desires position in hosiery, or in any field. Would like to work as an assistant to head dyer in a woolen or rayon mill. Age 42; married. Will go anywhere in the United States.

A-B-C-D-1

Education—Lowell Textile Institute, Bachelor of Textile Chemistry; Lowell Textile Institute (Evenings), 2 years D. C. Electricity; 2 years A. C. Electricity.

Experience—Six years as chemist and assistant dyer with a large organization. Specialized in dyeing, finishing, bleaching and drying of woolens, worsteds, cottons, rayons and unions in the piece. Some sales experience. Desires position as chemist, dyer, finisher, bleacher or sales. Age 30; American citizen; Married.

A-B-C-F-1

Education—Textile Institute course in Dyeing and Chemistry; Extension work at Brown University; Executive Training with Alexander Hamilton Institute of New York, N. Y.; working knowledge of one foreign language.

Experience—Dyeing executive on all types of textiles including stock, yarns in the skein, warp and package, and piece goods. Thorough knowledge of all classes of dyes and dyestuffs and their successful practical application in the plant. Extensive knowledge of all types and makes of equipment for dyeing, bleaching, mercerizing and finishing. Laboratory practice in testing, standardizing, purchasing, costing, planning and checking processes, and market analysis. Good manager of personnel for better efficiency in retaining friendly labor relations. Conversant with modern methods for quality production economically secured through better coordination and correct alignment in processing, on cotton, viscose and acetate rayon, silk, wool, worsted, and mixtures. In excellent mental and physical health; excellent references.

A-B-D-1

Education—Special courses in general chemistry.

Experience—Twenty-nine years' experience in application and standardization laboratories of various dyestuff manufacturers. Well versed in the application of dyestuffs to different textile fibers, i.e., wool, cotton, rayon, silk, acetate rayon and unions, using direct, acid, diazo, sulfur, acetate rayon, chrome and after-treated direct dyestuffs. Six months' actual dye house experience on jigs, open boxes, padders, bleaching and mercerizing. Experience demonstrating sulfur and direct colors at various mills. Seeks position as textile colorist in application laboratory and demonstrator.

Age 46; single; references.

A-D-1

Education—Graduate of New Bedford Textile School, 1936.

Experience—Chemist for woolen mill 7 months; technician and salesman for chemical company 1 year and 9 months. Seeks position as salesman or in purchasing department.
Will go anywhere; married; references.

B-5

Education—High School and Textile School Graduate.
Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Graduate New Bedford Textile School; also post graduate work in advanced microscopy and rayon testing.
Experience—Five weeks in color shop of print works. Wants position in anything associated with textile chemistry, dyeing, finishing and testing.
Single; age 21; references.

B-C-3

Education—Graduate, Philadelphia Textile School; speaks German fluently.
Experience—Employed at velvet company for 7½ years. Past 2 years working in finishing department on regular, waterproof and crush-resistant finishes (resin finishes). Can take charge of finishing of velvets. Have some piece dyeing experience.
29 years of age; married; will go anywhere.

B-D-1

Education—General education in England. Chemistry and Dyeing Courses at Huddersfield Technical School.
Experience—Has been a superintendent of dyeing since 1911. Has had experience in worsted mills, hosiery mills and woolen mills. Congenial, sober and reliable. Married; references; age 53.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.
Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.
43 years of age; single, in good health; will go anywhere.

MEMBERSHIP APPLICATIONS

Senior

James A. Branegan, Jr.—Chemist, Kali Mfg. Co., Philadelphia, Pa. Sponsors: S. G. Davenport, J. A. Branegan.

John Schofield Boyd—Technician, Ciba Co., Providence, R. I. Sponsors: R. F. Culver, W. H. Wightman.

Bernice S. Bronner—Director of Textile Testing, Good Housekeeping Institute, New York, N. Y. Sponsor: H. C. Chapin.

C. Eugene Coke—Research Chemist, Courtaulds Ltd., Cornwall, Ontario, Canada.

William P. Hall—Chemist, Joseph Bancroft & Sons Co., Wilmington, Del. Sponsors: A. L. Lippert, G. A. Billingsley, Jr.

Paul Alexander Hurlocker—Overseer of Dyeing, Kerr Bleaching & Finishing Works, Concord, N. C. Sponsors: G. S. McCarty, T. J. Hall.

Max B. Kaesche—Salesman, Sandoz Chemical Works, Inc., New York, N. Y. Sponsors: J. E. Meili, J. C. Walker.

David MacGregor—Chemist, Franklin Process Co., Philadelphia, Pa. Sponsors: M. T. Riddiough, R. W. Hunt.

James L. Nauman—Chemist, Joseph Bancroft & Sons, Wilmington, Del. Sponsors: A. L. Lippert, G. A. Billingsley, Jr.

Ernest M. Olson—Textile Laboratory Technician, E. I. duPont de Nemours & Co., Inc., New York, N. Y. Sponsors: L. J. Roos, S. M. Conn.

William M. Thornton—Experimental Dyer, Wanskuck Co., Providence, R. I. Sponsors: F. L. McCool, J. W. Clark.

Ernst August Wolff—Chemist and Dyer, General Ribbon Mills, Inc., Catasauqua, Pa. Sponsors: F. E. Nevins, W. O. Neeb.

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Oliver J. Goldstein—Chemist, Burkart Schier Chemical Co., Chattanooga, Tenn. Sponsors: A. J. Kelly, G. S. McCarty.

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Charles C. Rapp—Salesman, E. I. duPont de Nemours & Co., Philadelphia, Pa. Sponsor: J. P. Conaway.

Peter E. Reth—Secretary and Sales Manager, Rusk Oil Co., Philadelphia, Pa. Sponsor: A. F. Bowles.

Stanley W. Rusk—President, Rusk Oil Co., Philadelphia, Pa. Sponsor: A. F. Bowles.

William J. Wood—Salesman, R. & H. Dept., duPont Co., Philadelphia, Pa. Sponsor: J. P. Conaway.

Student

Carl O. Carlin, Jr.—New Bedford Textile School. Sponsor: F. E. Busby.

Graham J. Littlewood, 3rd—Philadelphia Textile School. Sponsor: E. C. Bertolet.

Dustin Rawlinson—Lowell Textile Institute. Sponsor: L. A. Olney.

ANNUAL MEETING, SOUTHEASTERN SECTION

PERRIN N. COLLIER, Vice-President and Director of Research, Callaway Mills, LaGrange, Ga., was elected Chairman of the Southeastern Section at the annual meeting held in Atlanta on Saturday evening, January 27. Robert W. Philip, Editor of *Cotton*, Atlanta, Ga., who has been Chairman of the Section for the past two years, was elected Councilor of the Section, succeeding Mr. Collier.

L. L. Bamberger, Purchasing Agent, Lanett Bleachery and Dye Works, Lanett, Ala., was made Vice-Chairman,

succeeding Allen Jones, Superintendent of Muscogee Manufacturing Co., Columbus, Ga. Curt Mueller, Superintendent of Dyeing, Bibb Mfg. Co., Macon, Ga., was named as Secretary to succeed W. Fred Crayton of Du Pont, Columbus, Ga. A. R. Macormac of Alabama Polytechnic Institute, Auburn, Ala., was re-elected as Treasurer.

The new Sectional Committee consists of Mr. Crayton and C. Russell Gill, Southern Sizing Co., Inc., Atlanta, Ga.; A. K. Haynes, Rohm & Haas Co., Atlanta, Ga.; Paul K. McKenney, President, Swift Manufacturing Co., Columbus, Ga.; George H. Small, National Oil Products Co., Atlanta, Ga.; H. Gillespie Smith, Calco Chemical Co., Inc., Atlanta, Ga.; Paul G. Wear, Penick & Ford, Ltd., Inc., Atlanta, Ga.; and James I. White, National Aniline & Chemical Co., Atlanta, Ga.

William A. Stringfellow of Ciba Company, Inc., New York City, spoke to the meeting on "Mildew and Mold Prevention." George O. Jones of Callaway Mills, LaGrange, Ga., spoke on "Social Security." Entertainment was furnished by Graham H. Jackson, negro pianist, who staged a show at the National Convention in Atlanta in December, 1938. There were 63 members and guests of the Section present.

Respectfully submitted,

CURT MUELLER, *Secretary.*

Twentieth

ANNUAL MEETING AND CONVENTION

HOTEL COMMODORE

NEW YORK CITY

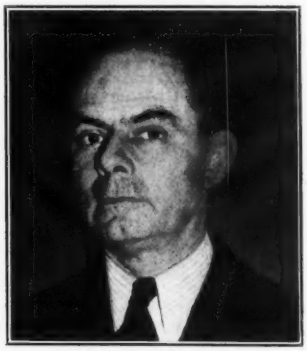
OCTOBER 18TH AND 19TH, 1940

General Chairman

PATRICK J. KENNEDY

Auspices of

NEW YORK SECTION



A. P. HOWES

Treasurer

A. P. HOWES, President of the Howes Publishing Company, will hold the office of treasurer for the twentieth annual meeting and convention. As publisher of the American Dyestuff Reporter, in which the Proceedings of the A. A. T. C. C. have appeared continuously since the issue of December 5th, 1921, he has enjoyed a long and intimate contact with the Association and its members. Having held the office of treasurer for the fourteenth annual meeting in New York City in 1934, he is well qualified for the position. At the present he is a member of the finance committee of the Association.

Soap

Am. Dyestuff Reptr.
29 65(1940)

A Discussion of Its Position as Related to Its Industrial Consumption

HENRY BARKER BURKE

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IN the field of practical chemistry, that is in that sphere of chemical achievement which becomes of immediate potential industrial or social value, the more commonly accepted opinion is that mere chemical accomplishment of a problem forthwith dooms all previous procedure and foreshadows prompt universal adoption of the newer product.

The error in such reasoning (that newly developed products must as a matter of course wholly supplant those previously employed) originates, no doubt, through overlooking or denying the fact, in the justifiable enthusiasm of accomplishment, that replacement or advancement in any sphere of activity is dictated by industrial or social demand, which in turn is governed more by economic circumstances than by any desire for perfection.

The benefits of academic exactness are constantly being sacrificed to commercial expediency and many a new and worthwhile technological advancement because of its time and place has yielded its originator only the "sickening pang of hope deferred."

Probably no more illuminating example can be cited of the unsoundness of such views—that new products, many admittedly of recognized merit, must supplant existing products in toto—, than in the case of that chemical combination known as soap in relation to the many recently developed combinations now being promoted for generally parallel practical uses.

Soap is a product devised through the inventiveness of man, for while nature supplies all the raw materials necessary to this combination, the product itself is not common to nature except in unemployable small amounts. Soap (the combination of fatty matter with a caustic lye) is known to have been in common use for more than 2,000 years and its use in a restricted way dates from a time now lost in antiquity.

However, not until 1791, when Le Blanc perfected his process for making soda ash did the manufacture of soap take on anything of its present industrial aspect, and indeed, it was not until several years later when the French chemist Chevreul gave the world its first definite knowledge and understanding of the true nature of oils and fats, that the manufacture of soap was placed upon a sound technological basis.

A product whose use antedates the recorded history of mankind must have some unique and very meritorious properties and characteristics, and must obviously be very difficult to dethrone from its universal demand in the arts.

But here it is well to recall the fate of madder-root (containing the active principle, alizarin), used for thousands of years in the dyeing of the justly famous Turkey Red. Also, recall the fate of natural indigo whose known use extends back more than 7,000 years. As the discoveries of Graebe and Lieberman in their relation to the constitution of alizarin, and the work of Adolf Baeyer and others, who worked with indigo were finally crowned by the economic justification for these synthesized products, so may the page of history turn on soap.

It is quite interesting, as well as instructive, to note that much the same forces which culminated in the overthrow of these long established dyestuffs are now operating through scientific and promotional effort aimed at the overthrow of soap. The effort is predominately Germanic; the force economic circumstances. That the eventual end point may be an improvement of product within the range of universal economic justification does not in any degree modify the statement.

Germany lacked madder; Germany lacked indigo. Germany is now and has been distressingly low in fats. No force can activate a greater national effort to concentrated research among an intelligent people than national scarcity of a vital necessity.

The laboratories of Germany with their 12,000 chemists have been worked overtime to devise means to attain national self-sufficiency and in no particular sphere have they placed greater emphasis than in the economy of fatty matter. Just how far this work has progressed and the extent of its stimulation on outside nations will be discussed further in this article, but it may be set down here and now that whatever may be the commonly accepted individual industrial viewpoint regarding these synthetic substances—whether it is the glamour of newness or their clear-cut performance and possible economies that dictate their use, the entire German point of view in their present adoption is based solely upon economic circumstances in which they as a nation find themselves.

Let us now review some of the more important chemical facts about soaps, especially as may be related to their industrial uses. Soaps are the salts of fatty acids formed by the decomposition of vegetable and animal oils and fats, consisting of glycerides of the fatty acids. Soaps consist chiefly of the alkali metal salts of the acids contained in the fats, (potassium, sodium and ammonium). That is they are the union of a weak acid and a strong base. But, regardless of the varying combinations of these

products, (that is the fat and the base employed) the resulting product is commonly known to us as a soap.* All such soaps, (Na,K, and NH_3) are soluble.

By a process known in chemistry as double decomposition, (sometimes purposely carried out and sometimes accidentally encountered) "metallic soaps" are formed. The most common, as well as the most useful, and at other times the most troublesome being calcium, magnesium, aluminum, lead, zinc, copper and iron. Such soaps are insoluble in water.

Therefore, in the ordinary sense, soap is understood to refer to those compounds formed by action of fatty acids or their glycerides upon the bases of potassium or sodium, and less frequently ammonium.

Chemically this reaction which we term saponification can be more accurately described as a process whereby an ester is split by water (hydrolized) to form an alcohol and a fatty acid, which fatty acid in turn is neutralized with alkali to form a soap. Graphically this is represented as follows:—

$C_3H_5(C_{17}H_{35}COO)$ + $3\ H_2O$ →
Tallow, the most commonly used soap stock *water*

$C_3H_5(OH)_3$ + $3\ C_{17}H_{35}COOH$
Glycerol, a tri-alcohol *Stearic acid, the fatty acid*

Then:

$C_{17}H_{35}COOH$ + $NaOH$ →
Stearic acid *Caustic soda*

H_2O + $(C_{17}H_{35}COO)\ Na$
water *Sodium stearate or common hard soap*

As has been stated these alkali metal salts of the higher fatty acids, (they may be stearic, palmitic, oleic, etc.) are soluble in water. Therefore, as might be expected they interact with acids by double decomposition according to the following:—

$(C_{17}H_{35}COO)\ Na + HCl \rightarrow NaCl + (C_{17}H_{35}COO)H$

The fatty acids are thrown out of solution and rise to the surface. In practical use this is quite naturally a troublesome occurrence and steps must be taken to guard against it.

When "hard" water is encountered, (which contains calcium, magnesium and possibly other metals in solution, a reaction takes place of which the following is typical.

$2\ (C_{17}H_{35}COO)\ Na$ + $CaSO_4$ →
The soluble soda soap *calcium sulfate the hardness*

$NaSO_4$ + $(C_{17}H_{35}COO)_2\ Ca$
sodium sulfate a neutral, soluble salt *the insoluble calcium soap*

The soluble fatty acid salt, in this case sodium stearate, is changed to its insoluble calcium salt, calcium stearate, through contact with the calcium salt in solution. This reaction continues at the expense of the soap so long as any "hardness" remains. And until the "hardness" has been expended, the cleaning action and utility of the soap is nullified.

Sometimes this reaction is made to serve very practical ends such as shower-proofing or the forming of bases in the manufacture of greases, but generally it is an unwanted phenomena and we take various simple means to circumscribe it. But, admittedly it is troublesome factor number one in the use of soap.

Soap solutions are colloidal bodies and upon this fact, and because of the certain characteristics common to colloids, we obtain many of our most important pratical advantages in the use of soaps. In particular, we might mention the forming of emulsions and the holding of dirt in suspension.

In general, the formation of an emulsion is the result of a greatly reduced surface tension on the part of one of the mutually insoluble liquids when such liquids are brought together. Colloidal solutions such as soap have definitely low surface tension, and common to colloids tends to reach a higher degree of concentration in the surface layer of the liquid. Soaps, therefore, may lay claim to being the first practically used surface active agents and not only first in this respect but still one of the most important of our wetting out agents.

Detergency is the act of cleansing and when one refers to the detergency of a product as being good or bad, they are evaluating its worth as a cleansing agent. Soap is our premier detergent and outstanding cleansing agent.

The mechanics of this cleansing process depends largely upon the property of colloidal soap solutions to adsorb the dirt particles which have been freed through emulsification from their oily or greasy matrix or bonding. These released dirt particles are held in suspension in the colloidal solution (dilute soap) and are removed with it when this solution is eliminated from the impregnated material.

Hidden under the brevity of comment upon what is most generally described as "hydrolytic dissociation owing to a weak acidic character" is probably one of the neatest chemical mechanisms to be met with. It is the rather unique ability of soap to automatically regulate the proportion of free alkali which is common to its solutions.

When soap is dissolved in a small volume of water it releases a small amount of alkali, but this same soap when dissolved in a large volume of water releases a large amount of alkali. However, the larger volume of water automatically maintains a concentration of uniformity. This is one of the chief factors controlling the surface tension of soap solutions. It is also the factor upon which the safety and effectiveness of degumming silk by soap is effected. We could add the requisite amounts of alkali to any degumming or scouring solution but we

*While the vegetable and animal oils and fats consist largely of the glycerides of the higher fatty acids, sperm oil and a few others prove exceptions, as the fatty acids in these substances are in combination with solid monatomic alcohols. This in the case of sperm oil being cetyl alcohol—$C_{16}H_{33}OH$—in place of the glycerin radical.

have never been able to devise any practical means to regulate the uniformity of the concentration.*

Another plan of nature which it would seem must have been preconceived for our advantage in connection with our use of soap is that chemical combination known to us as Zeolites.† They occur in nature but may also be synthesized. We mention them only because of their complementary relation to the use of soaps.

They are chemically double silicates of aluminum and sodium with water. Their peculiar advantage and usefulness lies in the fact that when in contact with water containing "hardness" (calcium and magnesium) these elements are withdrawn and the sodium of the zeolite takes their place to form soluble salts, that is to "soften" the water. Later when the amount of sodium in the zeolite has been used up (exchanged for the calcium and magnesium) one may flush out the calcium and magnesium which it has withdrawn from the hard water by treating it with a solution of common salt, whereupon it (the zeolite) will reverse its preference and withdraw all the sodium from solution which displaces these chemically absorbed substances (Ca and Mg) in the zeolite. The zeolite is then ready to reverse operations again and exchange its sodium for more "hardness." In general, this is the procedure common to the Permutit process of softening water. Carefully controlled it gives zero hardness. It is so allied with the broad application of soap as to demand recognition.

It would now be well to list some of the uses to which soaps are put in order to emphasize the almost universal industrial applications of this product.

1. Scouring of raw wool.
2. Cleansing of oily piece goods (wool).
3. Felting wool fabrics.
4. Kier boiling (cotton).
5. Bleaching and cleaning of cotton and rayon goods.
6. For wetting out textiles.
7. As emulsifying agents.
8. As levelling agents in dyeing.
9. For foam dyeing.
10. As softening agents, or in their make-up.
11. As filling agents, or in their make-up.
12. Shower-proofing products.
13. As bases for greases.
14. For metal cleaning and rust-proofing.
15. As domestic and toilet detergents.

Then there are other less important uses throughout the industrial trades.

This then is the material—SOAP—which either because of its real or imaginary defects there is great talk about replacing by an appropriate synthetic product.

We have indicated that the source of this pressure for replacing soap with synthetic products has had its origin in Germany. That commercial interests both in an out of Germany should attempt to capitalize upon the inherent weaknesses of soap in view of the chemical advances made in special products or that the advance made in these special products should of themselves stimulate the chemists of other countries to experiment along similar lines is not strange. In fact, a tremendous amount of investigation and development work has been done and a wide variety of products** have been presented to the trade many of which have a real merit in special applications. And for these, special applications find a ready market even at an advanced price over soap. Still we are far from any widespread and general adoption of such products in place of soap.

During the World War (1914-1918) Germany was under very stringent regulations as to fat economy. The present war has brought about a return of similar stringent laws: laws which are substantially a reprinting of the previous regulations. It should be borne in mind that these regulations have been in a measure operative even through this past 20 year period, except for the out and out rationing of edible products. And under the 4 Year Plan, (a plan for the mobilization, development, and conservation of all German resources with particular emphasis upon the development of synthetical raw material) there has been an intensification upon devising ways and means to overcome their appalling fat shortage. It will, therefore, disillusion some who may have felt that improvement in product rather than economic consideration was and now is the motivating force underlying these developments.

A summary of these regulations obtained from a German correspondent will give the reader a much clearer picture of the economic circumstances which have played so large a part in the pressure to substitute synthetic detergents in place of soap.

1. He states that fats have been prepared synthetically, and while the methods have not been wholly satisfactory, commercial plants are now being operated. The first large scale commercial plant to produce fatty acids synthetically by the oxidation of paraffin hydrocarbons was put into commission late in 1937. (This is confirmed by our own Dept. of Commerce Reports.) It was supposed to have an annual capacity of 20,000 metric tons, (1 ton being equal to 2200 lbs. av.). In all, three such plants were planned. The second one is now in operation. The product is suitable for the soap industry and it was hoped that these plants would supply 25 per cent of the requirements of the soap industry.

2. Every kind of oil and fat is being recovered, as oil from various fruit seeds, plum stones, peach stones, cherry

*Japanese sources claim to have been able to control alkali as a degumming agent, without detriment to the fiber. Dependent upon the degree of degumming and what is interpreted to constitute an acceptable quality of the work, this expedient has been made use of in other countries previously. Its limitations outweighs its practicability.

†Zeolytes are also important in the economy of plant life.

**The progress of this development advanced slowly in the prewar era from the simple fatty acid salts (soaps) thru sulfonated fatty acids (Turkey Red oils) to the higher sulfonated products of similar type (Monopole oils). In the postwar era sulfonated aliphatic alcohols appeared and then in rapid succession a series of fatty acid synthetic modifications of which the most notable have been the Igepons and more recently the Igepals.

stones, grape seeds, sunflower seeds, etc. Also from the embryos of grains, as wheat, oats, corn, etc.

3. Fish oils are being hydrogenated and made into solid edible fats.

4. No fat can be used for soap until all the glycerin has been removed.

5. Washing powders for domestic use are being made up of clay and other colloidal inorganic substitutes.

6. Garbage greases are being recovered completely.

7. All fats are being recovered and reconverted from sewerage. The potential amounts available from this source is based on a nation wide survey (1914) which revealed an average of over 4 kilos (8.8 lbs.) being eliminated per person yearly. In Berlin this went to 7 kilos. Various contaminations make recovery not only difficult but really uneconomic, especially when converted to edible products.

8. In industrial use, the mineral oils and waxes replace all fatty oil combinations.

9. Great emphasis is placed upon the manufacture of a class of "fatless" textile detergents known as Igepal.

10. The utilization of rosin oils and of "sulfitesoap" (from paper mill wastes) for soap combinations.

11. The installation of water softening plants on a national scale, and adapted to the water conditions of the region in which located.

12. Butter and margarine and all other edible fats are being rationed.

From these comments it is plain to see the importance the German government places upon the conservation of natural fats and notwithstanding the fact that she (Germany) holds an advanced position in the art of synthesizing the "fatless detergents" she has attempted to reduce her soap consumption only through indirect means rather than by direct synthetic replacements.

Probably no phase of this economy program presents a truer picture of the position in which soap now stands in relation to its possible substitution by synthesized products than the fact that not more than 25 per cent of Germany's 275,000 metric tons of soap consumption is to be supplied through synthetic substitution products. (It is thought that this 25 per cent reaches the upper limit of consumption—at least for the present—for special uses of distinct merit even though the economic soundness of the application is not always justifiable.)

In addition to this fact, it must be apparent that any national program of fat conservation embracing as this does the costly erection of water softening plants in every industrial center and community throughout Germany and accommodated to these varying water conditions according to location has been based upon the conviction that soap is and will be for some time the premier detergent.

The influence of German chemical activities upon the world is large and much of our activity to supplant soap by synthetic products has its origin or at least owes its incentive to German sources. Our soap consumption is only a little greater than that of the Reich and it would seem reasonable to expect that these new synthetic products in special industrial applications would have a proportionately parallel potential market. In our case, say around 150 million pounds per year (25%). It is also reasonable to expect that from time to time various means to economize the soap bill will be tried, but for the most part these will be rediscoveries by a later generation which if continued in use at all will be used because of the then present prevailing economic conditions and not by merit either recognized or unrecognized.

But none of these products so suitable as they may be to special applications nor the economies which may be instituted to reduce soap consumption will be found to reduce our Industrial soap consumption much below 350 million pounds per year.

Of course, some of the more than 1,400 soap manufacturers of the U. S. A. may feel the pressure of a reduced market when these special applications justifying the use of synthetic detergents become more effectively sold, (approximate the potential consumption for this class of goods which we have based on the German experience of 25% of their soap consumption). When in addition to this another 10% is economized through various soap saving expedients there is bound to be a considerable contraction in the list of our soap manufacturers.

However, the 80 or more well capitalized soap manufacturers should if they keep abreast with commercial progress be able to defend their position as regards a reasonable volume of soap business and to themselves develop dependable products to meet the threat of the synthetic products. But it is safe to predict that the relative simplicity of manufacture, coupled with low cost and universal adaptability of soap will secure its continued use in sizable volume for many years to come.

Vat Dye Progress—

(Continued from page 60)

this bath which is gradually heated to 80° to 90° C. and within a further ½ to 1 hour the development is complete.

Cupric chloride and potassium sulfocyanide can be used instead of copper sulfate and ammonium sulfocyanide if so desired. It is claimed that with such a dye (equivalent to Indanthrene Blue RS) a pure correctly developed shade is obtained.

Turning now more particularly to the application of Soledons it was discovered (E. P. 350,499) that while oxidation could be effected with ferric salts, for example, ferric chloride, the difficulty of over-oxidation could be much reduced by having present a ferrous salt. There would in this case appear to be a possibility of a balance between ferric and ferrous iron thus:

$$Fe''' \rightleftarrows Fe''$$

and by having present at the outset of the development a suitable ratio between these two forms of iron salt, over-oxidation is avoided. Sulfuric acid is also necessary. In

the development either a mixture of ferrous and ferric chlorides, or of ferrous and ferric sulfates can be used. The oxidizing action of the ferric sulfate or chloride can be increased by the presence of another oxidant such as a bichromate or sodium nitrite.

The following examples illustrate how this method is carried out:

Wool is dyed with the water-soluble form of Indanthrene Blue RS (sensitive to over-oxidation) and development is then carried out by treating the wool material for five minutes in a bath at 90° C. containing 2 per cent (calculated on the wool) of ferrous sulfate crystals, ½ per cent of ferric sulfate crystals, and 1 per cent of sulfuric acid. It is found that development is complete within this period but even if it is extended by another five minutes no deterioration of shade occurs.

In a padding method, cotton fabric is impregnated with a 2 per cent solution of the same Indanthrene Blue RS, and then dried. It is afterwards developed by immersing the fabric for 10 minutes in a bath at 80° C. prepared with 2 per cent of ferrous sulfate crystals, 1 per cent of sulfuric acid, and 1 gram per liter of sodium nitrite (this is the auxiliary oxidant). Here again it is found that the period of immersion can be extended considerably over the minimum necessary without dulling the blue shade which results.

Some ten years ago the idea of using a buffer substance in the development was suggested, the idea being that to some extent excessive oxidizing power would result in destruction of the buffer substance rather than the dye. It has already been mentioned that copper sulfocyanide can be usefully employed as an oxidant and that it has the effect of mitigating excessive oxidation, so it is not surprising to find (E. P. 361,165) that ammonium or potassium sulfocyanide is recommended apart from the copper as a suitable buffering substance.

According to this method, wool dyed with the Indigosol equivalent of the vat dye Ciba Blue 2R is developed in the exhausted dye bath by adding 2 parts of ammonium sulfocyanide and 1 part of potassium bichromate together with sulfuric acid (10 grams per liter). Development is commenced at 30° C. for ¼ hour and continued for a further one hour at 85° to 90° C. Over-oxidation of the dye is thus avoided by reason of the fact that the sulfocyanide is attacked before the dye.

It is now interesting to turn to expedients for avoiding excessive oxidation in the steam methods of printing with Indigosol and Soledon dyes. Here again, the idea of having a suitable buffer substance in the printing paste appeared to be a likely solution to the problem, but this time, according to an early patent (E. P. 344,964), aromatic aminosulfonic or carboxylic acids are suggested. Those acids derived from aniline and its homologues are recommended because they are water-soluble, give little discoloration to the print, and are not appreciably volatile in steam. Sulfanilic acid and its diethyl derivative have been found satisfactory.

The following example illustrates how printing of the Indigosol color is carried out under these circumstances:

First the printing paste is prepared with:

7.2 parts of the Indigosol dye
4.2 parts of the sodium salt of sulfanilic acid
13 parts of water
8 parts of ethyl tartrate
50.6 parts of gum tragacanth thickening
12 parts of 10 per cent sodium chlorate solution
4 parts of 1 per cent ammonium vandate solution
1 part of ammonia

This paste is printed on cotton fabric which is then steamed in a rapid ager for 10 minutes, being afterwards soaped at the boil for one minute and finally washed. In this manner a good black shade is obtained but if the buffer substance (sodium sulfanilate) is omitted then excessive oxidation of the dye occurs and a thin greyish green shade results.

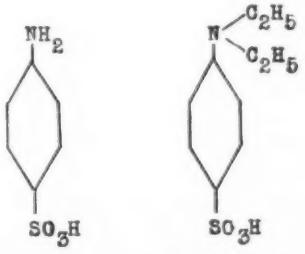
It is noted that development of the dye occurs during the steaming—there is no after oxidation treatment. The oxidation during steaming results from the action of the diethyl tartrate which decomposes with liberation of tartaric acid capable of acting on the sodium chlorate and this, with the assistance of the vanadate as catalyst, oxidizes the dye.

The diethyl tartrate may be replaced by ammonium sulfocyanide as an acid-liberating substance, and the sodium sulfanilate by the sodium salt of diethyl-aniline sulfonic acid. A printing paste of this type is given below:

3 parts of Indigosol dye
2 parts of sodium diethyl-aniline sulfonate
22 parts of water
60 parts of gum tragacanth thickening
8 parts of a 10 per cent sodium chlorate solution
4 parts of a 50 per cent ammonium sulfocyanide solution
1 part of a 1 per cent ammonium vanadate solution.

It is found that after printing and soaping as described in the former example, a poor dull over-oxidized shade results if the sodium diethyl-aniline sulfonate is omitted.

The chemical structure of these buffer substances is indicated by the following formulae:



Sulfanilic Acid — N-diethyl-sulfanilic acid

The amino group NH_2 or substituted amino group $N(C_2H_5)_2$ is susceptible to oxidation and can thus curb the oxidizing power of the sodium chlorate so as to

preserve the dye from over-oxidation. On the other hand, these buffer substances have both basic (NH_2) and acidic (SO_3H) groups so that these by balance (buffering) can modify the acidity developed by decomposition of the diethyl tartrate or ammonium sulfocyanide and in this way modify the oxidizing power of the sodium chlorate which develops only in the presence of acid. It is on these factors that the effectiveness of the buffering substances in preventing over-oxidation of the Indigosol dye depends.

E. P. 389,106 deals with the dyeing of wool and the development of the final shade in an oxidizing bath and it is claimed that a number of new selected organic compounds can be used as buffers in the developing bath. Among the substances mentioned are thiodiglycol and thiourea; it also seems possible to use the sulfanilic acid derivatives (particularly the sodium salt of dimethylaniline sulfonic acid) noted above for use in printing. Thus wool dyed with an Indigosol dye is developed in a bath containing 3 parts of thiodiglycol and 1 part of potassium bichromate together with sulfuric acid (10 grams per liter) under the usual conditions at 85° to 90° C.

It is believed that in such dilute solution some part of the buffering action of these compounds is due to destruction of the buffer substances in preference to the dye. These new buffers have the following chemical constitution:

Thiourea — Thiodiglycol

The buffer substances so far described are more or less inert except in so far as they are capable of oxidation by a powerful oxidant; they have no special reducing properties. But a later discovery (E. P. 426,073) indicates that the prevention of over-oxidation can be brought about in a more positive manner in those processes where the dyed material is developed in an oxidizing bath and not by a steaming treatment. Suitable reducing substances are stannous and titanous chlorides, these being inorganic in contrast to the definitely organic character of the buffering substances mentioned above. Actually these chlorides are quite strong reducing agents and it is somewhat surprising that since they are present with the oxidant (nitrous acid) in the developing bath they do not immediately attack and reduce this before it has the opportunity of oxidizing the dye.

The following example illustrates how this new principle of development is carried out.

Cotton is first printed with the following composition:

17 parts of Indigosol or Soledon dye
5 parts of diethylene-glycol-diethyl-ether
12½ parts of water
8 parts of urea
55 parts of gum tragacanth thickening
2½ parts of a 30 per cent solution of sodium chlorate

and then dried. The fabric is then passed through a developing liquor at 70° C. containing per liter, 36 grams of sulfuric acid and 7.5 grams of stannous chloride (this may be substituted by titanium chloride when desired) and given an air-run of 30 seconds. Afterwards it is soaped at the boil and washed and dried. Over-oxidation of the dye is completely avoided in this manner even when the dye is specially susceptible to such decomposition.

Attention may now be drawn to the latest progress made in this search for a development method which ensures satisfactory oxidation with mixed dyes. It is now found (E. P. 503,699) that ortho- or para-dihydroxy- and ortho- or para-hydroxyamino aromatic compounds serve excellently as buffers. Such compounds are hydroquinone, para-aminophenyl and its N-methyl derivative (pyrocatechin), 1:4-naphtho-hydroquinone, 1-amino-2-naphthol-4-sulfonic acid, pyrogallol, gallic acid, and tannic acid. All of these substances are characterized in being easily converted by oxidation into a quinone or quinone-like product. The amount of such substance required to be in the developing bath is quite small and indeed somewhat smaller than that which might be involved in change by oxidation.

In this connection it may be recalled that recent practice in vat dyeing involves the addition of tannic acid to the final bath (also to the dye bath) in washing off vat dyed material. The usual danger is that during oxidation of the vat dye to its true shade a simultaneous oxidation of the textile material takes place with resultant undesirable tendering. The tannic acid protects the textile material, and it would seem that in the development of Indigosol and Soledon dyes it can also protect the dye from over-oxidation.

The high degree of efficiency of the new method is shown by the following recorded experiments using an olive green Indigosol dye.

Dull viscose rayon fabric was dyed for ¾ hour at 20° C. in a solution containing:

0.3 parts of a wetting-out agent (the sodium salt of 1-propylnaphthalene-1-sulfonic acid)
0.09 parts of the dye
7.5 parts of Glauber's salt
300 parts of water

and then mangled. The fabric was then cut into two equal portions, both being further developed separately in similar baths containing (per 1,000 parts) 36 parts of sulfuric acid, 1 part of sodium nitrite, and 0.5 parts of hydroquinone, but one bath was 20° C. and the other at 60° C. In each case the development was carried out for ¼ hour. The developing bath at 60° C. should give considerable over-oxidation. After washing, soaping, and further washing the two fabrics it was observed that they were practically identical in color. In another experiment where the hydroquinone was omitted from the developing baths the shade of the fabric developed at 20° C. was slightly dull due to a moderate degree of over-oxidation while that of the high temperature developed fabric was much duller due to considerable over-oxidation.

It would appear that these hydroquinone substances will be of much assistance to dyers and printers of both vegetable and animal fiber materials with Indigosols and Soledons. So far, no further buffering compounds have been discovered and so this review of progress in the application of these special water-soluble forms of vat dyes must come to an end. These dyes have now been in a state of development during nearly twenty years. Progress in the early years was slow, but recently it has been much accelerated and the dyes themselves have come into more favor among dyers and printers. They are perhaps somewhat costly for deep shades but for the production of pastel and moderately deep shades they are much more convenient and not appreciably more expensive than ordinary vat dyes. This chapter in dye chemistry illustrates how necessary it is in the perfecting of textile treatments to be willing to expend much effort and to have considerable patience.

• TECHNICAL NOTES FROM FOREIGN SOURCES •

General Trend of Modern Finishes

L. G. Lawrie—Jour. Soc. Dyers & Col., 55-7, *July*, 1939.—This paper presents an interesting survey of the surprisingly large number of new compounds now available for textile finishes which have in recent years been produced in the field of organic chemistry. A useful classification is made of the more important of these compounds, by which they are divided into four main groups: (1) Long Chain Aliphatic Compounds; (2) Synthetic Resins; (3) Cellulose Derivatives, and (4) Quaternary Ammonium Compounds. The more important members of each group are then considered in some detail. It is noted that members of groups (2), (3) and (4) are broadly designed to give permanent or semi-permanent finishes.

(1) Long Chain Aliphatic Compounds: This class may be generally described as surface-active agents. A compound of this type consists of a long aliphatic, usually hydrocarbon, chain with a polar group at the end. The polar group has an attraction for water, the attraction being greater the shorter the length of the aliphatic chain, which in itself possesses an attraction for non-polar substances, such as fats, and repels polar substances. Such a compound, when placed in water, is therefore considered to orient itself with the polar head in the water and the aliphatic chain in the air, forming a perfectly symmetrical film one molecule thick. On this property of orientation and the natural attraction and repulsion of the two ends of the molecule are based the valuable properties of the new wetting agents, dispersing agents and detergents. If the aliphatic chain is relatively short (12 carbon atoms or less) a class of compounds called wetting agents is obtained. They possess the property of breaking down the interface between greasy fibers and water with great rapidity, even when only very small quantities in aqueous solution are employed.

The new detergents of the sulfated alcohol type form another group of this division. Like the wetting agents, their molecules consist of a long aliphatic tail with a polar head, usually in the form of a sulfuric ester. For the detergents, however, it is necessary for the chain to be longer than 12 carbon atoms, usually running to 16, 18 and even 20, while the hydrocarbon may be saturated or unsaturated. Reference is made to the excellent detergent and stable qualities possessed by these compounds.

An interesting explanation is given of the action of these surface-active compounds as emulsifying agents. The long-chain aliphatic compound with a polar group at one end orients itself so that the aliphatic chain is anchored in the fat or oil which is being emulsified, while the polar head is dragged under the water. Agitation then distributes the oil as minute globules throughout the water, and, as each globule has embedded in it a compound with a polar head projecting which possesses an attraction for water, there is no tendency for separation or aggregation of oil globules, as they have now become mutually repellent. By aid of these compounds, therefore, emulsification is more easily carried out, and the emulsion so formed is of exceptional stability.

(2) Synthetic Resins: The number of these compounds available today can be counted in thousands. They are high molecular weight polymers which may be produced by two types of reaction—(a) by polymerization when single molecules unite to form larger complexes with no loss of atoms, and (b) by condensation and elimination of water, hydrogen, etc. Of the many different classes of synthetic resins known, five important types have been found of interest in textile processing—(1) phenol-formaldehyde, (2) urea-formaldehyde, (3) glyceryl phthalate, (4) acrylate and (5) vinyl resins.

Phenyl-formaldehyde resins have so far found a restricted application to textiles. The urea-formaldehyde resin is the type which is used for the production of anti-crease finishes and for making fabrics less liable to shrink. Glycerol-phthalate resins are extensively used in the production of full and firm finishes and in fixing pigment prints. The Vinyl resins are perhaps the most interesting of all. They are converted into colorless, highly pliable compounds which are thermoplastic. These are used to produce full and flexible finishes which are fast to washing and drycleaning.

(3) Cellulose Derivatives: These have long been known in such forms as viscose and cellulose nitrate solution. Recently introduced cellulose ethers, some of them water

soluble, are receiving some attention in the textile trade as finishes and pigment binders.

(4) Quaternary Ammonium Compounds: These are compounds containing pentavalent nitrogen, four valences of which are occupied by hydrocarbon groups. When associated with long-chain compounds they form a new class of products, some of which possess unique properties as finishes. Such compounds now on the English market are Fixanol, Sapamine, Lissolamine and Velan PF. Fixanol is a water soluble product which, by a simple after-treatment, renders direct cotton dyeings fast to water, acids and perspiration. Even such a sensitive color as Benzopurpurine, it is stated, can be made acid fast by such treatment. Lissalomine is described as an extremely efficient stripping agent when used in conjunction with a reducing compound such as alkaline hydrosulfite. Velan PF is a product which for the first time gives water repellant effects resistant to washing, laundering and dry cleaning, without giving the fabrics so treated any harshness.

Such a paper should serve as a useful classification and description of these interesting products, a reference source of real benefit to the textile man who appreciates their importance from a practical stand point, but who is not himself a specialist in organic chemistry.

Printing by the "Burn-Out" Process

P. Rouvcyre—TIBA, No. 7, July, 1939.—An interesting printing process, though one perhaps not very widely practiced in this country, is here described in detail. It is not easy to say whether the French designation of this particular style of printing ("devorant") is more or less expressive than our English equivalent; at any rate the method is based upon the differing degrees of resistance offered by two kinds of fibers to a destroying agent, however the action of this agent is characterized. This implies the use of a mixed fabric, and as a matter of fact, though several types of goods might be considered, the process is largely confined to use on silk-back rayon-pile velvets. The material is printed with a corrosive agent which on subsequent heating destroys the rayon constituent, leaving the silk unaffected. The present article outlines the successive steps of the process, and enumerates some of the striking color effects which may be secured in working with such material.

The pieces are boiled-off and prepared for printing in the usual manner. For printing a rayon pile fabric, such as is being considered, aluminum chloride crystals is the corrosive agent commonly used. It is pointed out that best results are obtained by printing on the silk back of the fabric, penetration to the base of the pile being thus better assured. For ordinary roller printing, a paste containing from 15 per cent to 20 per cent of the crystallized chloride is generally employed. Locust bean gum (gomme de caroubier) is preferable as a thickener, as it does not coagulate or form lumps under acid action. For the simple "burn-out" effect the fabric is printed with a cold paste containing only the dissolved chloride, dried carefully in the hot-flue at 50° C., and passed into a heated chamber for carbonization. Here the aluminum chloride is hydrolyzed, and the liberated HCl (acid fumes are carried off by ventilation) destroys the cellulose of the pile in the areas where the print pattern has fallen. In practice it is found that a passage of 4-6 minutes at a temperature of 130° C. effects complete carbonization of the rayon.

The goods are next well washed, a little acetic acid being added to the first rinse, to remove completely the destroyed rayon and chemical residues from the fabric. They are then dried and ready for finishing.

Though this is the normal course of procedure, it may, however, be varied considerably if desired. Printing and carbonization, for example, may take place before the boil-off, or the goods may be dyed before printing.

The numerous color effects possible to secure when working with such fabrics are discussed at some length. Differential dyeing may be employed, and certain colors may be applied along with the aluminum chloride, either in straight application or as illuminants for discharge effects with the use of hydrosulfite. Two illustrations of sample prints are given.

The process here described is no doubt capable of giving attractive and striking effects on certain fabrics. The opinion may be hazarded, however, that it is not a very safe one for use except in hands which are both capable and experienced.

The Dyeing of Nylon

G. S. J. White—Jour. Soc. Dyers & Col., 55-8, *Aug.,* 1939.—In the expectation that the manufacture of nylon is to be undertaken in England, a survey of the dyeing possibilities of this new fiber has been made by the Dyehouse Department, Dyestuffs Group, of the Imperial Chemical Industries, Ltd. A similar survey, embracing a complete tabular classification of the different types of dyes in respect to their individual affinities for nylon, was made in this country by P. H. Stott of the Du Pont Company and published in the AMERICAN DYESTUFF REPORTER (28-20) of Oct. 2, 1939. The results of the two investigations appear to be in fairly close agreement.

Though in almost all classes can be found dyes which possess more or less affinity for the fiber, in general the acetate rayon group presents the best method of obtaining level shades of reasonable fastness to light and washing. The acid wool dyes, especially those of the anthraquinoid, Coomassie and Carbolan types, will be found valuable where a higher degree of washing fastness is required, while demands for extreme light fastness may be met with vat and Soledon dyes.

TRADE NOTES • NEW PRODUCTS

OBITUARY

ROBINSON SUTTON WHEELER

R. S. WHEELER, superintendent of bleaching and finishing at Crystal Springs Bleachery, Chickamauga, Ga., passed away at his home in Chickamauga on January 8, following an extended illness.

Mr. Wheeler, a long-time member of the American Association of Textile Chemists and Colorists, was the dean of its membership in the South, and contributed immeasurably to the success of the organization in his native section, and nationally. He was an organizer of the South Central Section, had served as its chairman and national councilor. On the occasion of the national convention in Chattanooga in 1930, he was in charge of the arrangements, and directed the successful affair. He was a faithful attendant at the national conventions; his last activity, immediately preceding his fatal illness, being a trip to the annual convention in Boston in September.

Preferring to be inconspicuous always, Mr. Wheeler was a constant inspiration and progressive influence in the association; and in more than 40 years of service in southern finishing, provided more than his share of ingenuity and ability, and leadership in the growth and development of this industry, which he helped to build from an infant to a titan during his lifetime of service in it. His unusual length of activity never dulled his vision and progressive spirit; his years of experience, instead, strengthened his faith and his receptiveness to progress.

"Uncle Bob," as he was affectionately known to a legion of friends in the industry, and out of it, was born in Rockingham, N. C., in 1867. He began work at an early age at the Kerr Bleaching & Finishing Works, Concord, N. C., working up to the position of superintendent. In 1920 he went to Chickamauga, in charge of the plant there. Kind and cordial, always considerate and helpful — especially to younger men to whom he was a patron—he was constantly sought for advice and counsel, which he gave unstintedly.

Personally, Mr. Wheeler's character was reflected in his religious and charitable activities. For years he served as a member of the board of stewards of the Elizabeth Lee Methodist Church, as chairman of the board of trustees, and as superintendent of the church school. Unselfish and generous, a personal monument to him endures in a number of young people to whose education he contributed greatly.

In business, he saw his intense ambitions and hopes for the industry he served bear fruit, and a fitting epitaph to his work along this line may be found in the following extract from an article he prepared, only a few months before his death, on "Forty Years in Southern Bleaching and Finishing":

"Those in the finishing game today do not realize what those who were pioneers in the finishing of cotton goods in the South were up against some 40 years ago. There existed at that time a prejudice and a skepticism on two counts against goods finished in the South. First, we 'did not have the right kind of water' and if we had, the southern workers 'were too slow-witted to make satisfactory workers.' As an example of the prejudice which existed at that time, I recall that we had finished some 25 cases for an eastern concern, and upon receipt, the goods were refused. Our selling agent advised that if we would stand the expense of having the goods packed in eastern made cases he felt the goods would be accepted. This we did, and there was no further complaint.

"All of this prejudice has now happily 'gone with the wind,' and the cotton piece goods finished in the South are equal to those of any other section of the country, and in most instances, the plants are manned by southern men."

Funeral services for Mr. Wheeler were held from the Elizabeth Lee Memorial Methodist Church in Chickamauga, on January 9, with interment in the family lot at Concord, N. C., on January 10. Pallbearers were: C. Callaway, Jr., R. H. Jewell, Earl F. Hall, W. N. Shadden, J. D. Mosheim, and J. C. Wyatt, Jr. Honorary pallbearers were: D. A. Jewell, Jr., Malcolm Mackenzie, of Charlotte, N. C.; S. I. Parker, of New York; Harold T. Buck, of Columbus, Ga.; R. C. Staples, of Chattanooga; Dr. E. B. Osborn, J. C. Elder, C. Callaway, Sr., B. M. Powell, F. H. Henderson, W. H. Edwards, E. H. Wyatt, A. H. Bradley, and J. L. Moore, of Chickamauga; and the board of stewards of the church.—ROBERT W. PHILIP, *Councilor, Southeastern Section, A.A.T.C.C.*

• DISPLAMOR DIVISION, N.Y.W.F.

The New York World's Fair 1940 is presenting a new exhibit plan to advertisers providing for product display space through its specially created Displamor Division.

The plan is being offered at a moderate cost to both the small exhibitor who wants his product to be on display at the Fair, and to national advertisers who already have large exhibits at the Fair, but who wish to augment their main exhibit.

Displamor exhibits will be installed in the major buildings and consist of three dimensional displays, many of them animated. This medium was soundly tested at the Chicago Fair and is in fact the result of a demand for similar display advertising space at the World's Fair 1940, which prompted officials to inaugurate it here.

According to Harvey D. Gibson, chairman of the board, World's Fair Corporation, locations are being rapidly taken up by a number of advertising agencies on behalf of their clients both in New York and out-of-town, and advance reports from advertisers themselves are said to indicate much enthusiasm.

• DETECTION OF IMPURITIES

The presence of impurities in the amount of 0.01 per cent or less can now be detected in any given substance by subjecting it to a test recently perfected by scientists of the National Bureau of Standards, Department of Commerce, Lyman J. Briggs, Bureau Director, announced recently.

This feat is accomplished by freezing the specimen under examination and then comparing its freezing range with that of a similar specimen, frozen under identical conditions, to which a small known concentration of another substance has been added.

An absolutely pure substance is characterized by the fact that it always melts or freezes at precisely the same temperature. When an impure substance freezes, the temperature, in most cases, decreases steadily from the time freezing begins until it is completed. The magnitude of freezing range, or the range of temperatures within which freezing occurs, is an accurate yardstick of the amount of impurities contained in the substance under observation.

Knowledge of these facts has enabled Bureau scientists to determine the characteristics of any substance not lending itself to the more commonly used method of chemical analysis.

A publication soon to be issued by the Bureau will discuss in detail the sources of error generally encountered in freezing

techniques formerly used, and will describe the apparatus and methods developed to make the new studies successful.

• CHEMICAL MIXERS AND FEEDERS

A new bulletin describing Infilco chemical mixers and feeders for the uniform preparation and feeding of suspensions or solutions in water, sewage and process liquid conditioning and in other applications are now available upon request from International Filter Co., 325 W. 25th Place, Chicago, Ill.

Infilco chemical mixers and feeders, the bulletin points out, employ vertical agitation, which assures uniformity in the solution or mixture. They are said to offer the most accurate means available for feeding a suspension or solution. One of their advantages lies in the fact that two chemicals may be prepared and fed together. Another advantage is that the discharge can be divided into two variable portions for use at two different points.

The mixer and feeder tank has a half-round bottom which conforms to the path of revolving agitators and eliminates dead spaces where solids might settle. The plow-shaped agitators are revolved in such a way that liquid circulates constantly in vertical planes, preventing stratification.

Mixers and feeders can be equipped with manual variators for changing the dosage. They are also available with automatic proportioners for varying feed in proportion to the flow of liquid undergoing treatment. Units are offered in many capacities with different types of auxiliary equipment to fill all requirements.

• EFFICIENCY IN CONSUMPTION

That careful observation of textiles while being used by consumers can yield a wealth of information of value to store buyers, managers of testing laboratories, and of adjustment bureaus of retail stores, has been demonstrated by Alexis Sommaripa who spoke on January 18th, on "Efficiency in Consumption" at the Annual Convention of N.R.D.G.A. Mr. Sommaripa, who is the manager of Fabric Development of the Rayon Division of E. I. du Pont de Nemours & Co., based his talk on results of consumer wear tests, and particularly on the study of slips among 800 factory and store workers in which Sears, Roebuck & Company and Montgomery Ward & Company participated.

Mr. Sommaripa stated, in part:

"In determining the useful life-span of an item the most important question is at what stage of deterioration should it be considered 'no longer wearable.' In the sheet and blanket wear tests conducted by the Bureau of Home Economics, this decision is left to laboratory technicians who make the repairs and decide when an item is worn out and not worth mending. In the work of du Pont's Fabric Development it was decided to secure an extensive consumer background which could later be used as a basis for laboratory evaluation. Over 700 women were given slips and dresses to wear. They were to discard them as soon as they thought the garments were worn out and to make this decision on the basis of their previous experiences. We have made over 5,000 examinations of these garments in various stages of deterioration. We have found that factory and store workers are willing to wear, for a considerable time, slips which plainly show deteriorations. They are more particular in regard to nightgowns, and even more so with dresses. Due to the types of slips available in the last few years they have acquired a habit of repairing them numerous times. Obviously both of these conditions are a challenge to manufacturers and retailers to develop slips which do not need repairs and will not deteriorate early in use. Nevertheless, the conditions of deterioration as they exist in 1940 are to be taken as a basis for the present.

"Because the conditions of washing and discarding were not controlled, but left to the wearers, there is a great variation in the number of hours and washings secured from the same slip by different wearers, but this obviously corresponds to the conditions which exist in real life. The important thing is to have a group large enough to give an average which is truly representative for the group. It is important indeed to be able to repeat the test by the same group or by another comparable group and to obtain similar results. In the slip study, 100 wearers at Wards, and 300 at Sears had an identical item, the average for which, for the two groups were of the same magnitude.

"The co-efficient of variation which shows the percentage of fluctuation from the average is the basis on which the reliability of the results is to be tested, and from which the minimum number of people in the group can be determined."

• AMERICA AND CHEMICALS

America's self-sufficiency in chemical resources emphatically makes for peace, asserted Dr. Charles M. A. Stine, vice-president of E. I. du Pont de Nemours & Company in an address on January 12th before a joint meeting of the Society of Chemical Industry, American Chemical Society, American Institute of Chemical Engineers, The Electrochemical Society and the Société de Chimie Industrielle.

The occasion for the meeting was the presentation to Dr. Stine of the Perkin Medal, which is awarded annually by the American Section of the Society of Chemical Industry for "valuable work in applied chemistry."

Emphasizing developments in the organic chemical industry in the United States within the past two decades, the medallist declared that two signally tangible results have been achieved: "First, the fostering of a tremendous expansion in the training of research workers in our universities, and the promotion of a great and widespread interest in organic research. This has had significant repercussions in virtually all fields of research, leading to expansion and intensification of effort and to results of enhanced value.

"The second result," he said, "has been the tremendous contribution to national self-sufficiency in this country which the rise of our organic chemical industry has made. There is good ground for believing that self-sufficiency very definitely makes for peace. Through research and synthesis we have obtained methods of preparing certain materials of organic origin which are not available in this country because of limitations of soil or of climate, or for some other reason inherent in our national economy."

Warning against complacency, the speaker declared in part, "Let us not be puffed up with pride over our national state of mind. Research expenditures by American industry as a whole, if estimated correctly at $250,000,000 a year, are lower than the nation's annual bill for cosmetics by about $150,000,000."

Regarding the critics of applied science, Dr. Stine asserted that those who would attribute to our scientific development the blame for our present national and international ills take an entirely superficial view.

Dr. Charles M. A. Stine was born in Norwich, Conn., October 18, 1882. He was graduated with honors from Gettysburg College at the age of 18. Following graduate study he was appointed Fellow in Johns Hopkins University, from which he received the Ph.D. degree in 1907.

Shortly thereafter Dr. Stine joined the du Pont Company and was in charge of organic chemical research at the Eastern Laboratory, Gibbstown, N. J. from 1909 to 1916. In 1917, he came to Wilmington as head of the Organic Division of the Chemical Department. He later became Assistant Director and subsequently Director of the Chemical Department. In 1930 Dr. Stine was elected a Vice-President, a Director, and a member of the Executive Committee.

Under Dr. Stine's tenure as Director of Research in the central Chemical Department of the Company, a number of significant developments were recorded. Most important was establishment of a program of fundamental research from which resulted neoprene chemical rubber, nylon, and other important polymers.

Dr. Stine has developed numerous processes and products, many of them patented, in connection with dyes, paints, varnishes,

explosives, and other chemical developments. He is responsible for general supervision of research work in the Company.

• JOINS OAKITE

Expanding its chemical research facilities and services, Oakite Products, Inc., manufacturers of industrial cleaning materials since 1909, announces the appointment of Dr. A. Lloyd Taylor to its Technical Staff.

Because of his extensive activities in the field of industrial chemistry where he has directed numerous projects covering a wide range of industries, Dr. Taylor brings to his new post considerable experience. Having resigned his previous position as Director of the Department of Chemistry of Pease Laboratories, New York City, with whom he has been associated for the past six years, he will concentrate his attention primarily on chemical research and development of cleaning materials for production and related cleaning operations of major industries.

Dr. Taylor will also devote part of his time to technical field service, cooperating with the men comprising Oakite's nationwide service organization in the application of the different specialized cleaning materials originated and developed by the Company during the past 30 years and now widely used in numerous product processing and plant maintenance operations.

Dr. Taylor will be located at the Company's General Offices, 22 Thames Street, New York, where the research and service laboratories of the Oakite chemical and mechanical divisions are maintained.

• JOINS ARNOLD, HOFFMAN & CO.

Arnold, Hoffman & Co., Providence, A. I., manufacturers of textile chemicals for the past 125 years, announces the appointment of Iver W. Fallstrom as Director of Development and Application.

Mr. Fallstrom will have charge of the development and application of the various Arnold Hoffman resins, permanent finishes, substantive softeners, etc., as well as the rendering of technical service to the textile industry.

Mr. Fallstrom is well qualified for this work, being a graduate of Clark University and Massachusetts Institute of Technology and having been connected with the textile resins development for Hercules Powder Co. for the past three years. Prior to this he was for five years connected with the Sayles Finishing Plants, Inc., and for five years was chief chemist for the Aspinook Co.

• NEW WARWICK BULLETINS

The Warwick Chemical Co. has available new technical data bulletins concerning the following items:

Sulfanole P. B. & *Sulfanole C. P.*—synthetic detergents.

Appramine C & *Appramine* 40—cation-active softeners.

Hydrolux D—for vat printing and discharge printing.

Glysorbine—a hydroscopic and plasticizing agent, primarily suited for silk throwing.

Copies may be secured by writing to Warwick Chemical Co. on a business letterhead.

• CHAIRMAN, N. Y. FUND

Francis B. Davis, Jr., president and chairman of the board of the United States Rubber Co., will head the industry division in the 1940 campaign of the Greater New York Fund. The announcement was made this week by John A. Brown, president of the Socony-Vacuum Oil Co., Inc., and chairman of the spring drive.

As head of the industry division, Mr. Davis will direct volunteer workers and campaign activities in one of the seven major groups to which the Fund appeals for supplementary money needed by 396 voluntary, social welfare and health agencies. The division will seek contributions from more than 2,200 industrial firms in Manhattan.

The newly named chairman, born in Fort Edward, N. Y., in 1883, was graduated from Yale in 1906. He formerly was president of the du Pont Viscoloid Co. and chairman of the board of the Pittsburgh Safety Glass Co. He became president of the United States Rubber Co. in 1929.

Section chairmen to head the various trades in Mr. Davis' group will be announced soon. The appeal, which will be directed to business firms, corporations and employee groups exclusively, is scheduled to begin April 1.

• BOOKLET ON CASEINS

The Casein Co. of America, Bainbridge, N. Y., has recently brought out a booklet describing their "Protovac" modified casein and caseinate products. It is stated that these modified caseins and caseinates have new and different properties than regular casein due to the manufacturing process used. They outgrew the laboratory stage and entered commercial production several years ago. Properties, uses, types, plasticizers, defoamers, charts and graphs in connection with these products are described. Among the uses for these products are the following: paper coatings and sizings, leather finishes, water dispersed paints, adhesives and glues, textile finishes and sizings, medicinal and pharmaceutical preparations, foodstuffs and miscellaneous other applications. Copies of this booklet are available upon request.

• CIBA REVIEW

Ciba Review, Number 28 for December, 1939, features "The Spinning Wheel." Contents are deescribed by the following titles: Spindle and Distaff as Forerunners of the Spinning Wheel; The Indian Hand Spinning Wheel and its Migration to East and West; The Twisted Mill—The First Step toward Mechanized Spinning; The Spinning Wheel with Flyer Spindle and Treadle Drive; Types of the Spinning Wheel; Spinning in Art; Leonardo da Vinci's Ideas on the Mechanization of Spinning; Historical Gleanings.

• BY GUM!

By Gum!, publication of Reichold Chemicals, Inc., for December-January, contains an article by J. F. Maguire, Manager of the Industrial Development Department entitled "Fibers, Fabrics and Finishes" which should prove of interest to readers of the Reporter. Another article of interest to colorists is entitled "Dyes, Dry Colors and their Application." Copies of this publication are available upon request to the publishers.

• MEETING, S.O.C.M.A.

The regular monthly luncheon meeting of the Synthetic Organic Chemical Manufacturers Association of the U. S. was held on Thursday, January 11th, at the Chemists Club, New York City. Discussion was held on the status of the Trade Agreement program.

• QUARTERLY PRICE LIST

The Quarterly Price List for January, 1940, has recently been issued by the R & H Chemicals Department, E. I. duPont de Nemours & Co., Inc., Wilmington, Delaware. Copies are available upon request.

• COLUMBIA EVENING TEXTILE COURSES

The following schedule of evening textile courses has been announced for Columbia University:

Identification, Analysis and Testing of Textiles (Advanced); Wednesdays, 7:30 to 9:20; Begins February 7th.

Converting of Rayon and Spun Rayon Fabrics; Thursdays, 7:30 to 9:20; Begins February 8th.

Textile Chemistry; Lectures, 7:30 to 9:20 on alternate Fridays beginning February 9th; Laboratory, 7:30 to 9:20 on alternate Fridays beginning February 16th.

Cotton Goods Converting; Mondays, 7:30 to 9:20; Begins February 12th.

Woolen and Worsted Manufacture; Mondays, 7:30 to 9:20; Begins February 12.

Advanced Woven and Printed Fabric Design; Tuesdays; 7:30 to 9:20; Begins February 13th.

These courses are open to all without entrance examinations and continue for a period of 15 weeks. Instructors may be consulted from 7 to 9 p.m. starting February 5th in Room 301, School of Business Bldg., northeast corner of 116th Street and Broadway, New York City. All inquiries should be addressed to the director of university extension, Columbia University.

• CENSUS OF HOUSING

A comprehensive picture of housing and home ownership in the United States will be compiled from information to be gathered by the 120,000 Census enumerators in conjunction with the Sixteenth Decennial Census to be conducted by the U. S. Bureau of the Census in April. Data—in response to a schedule of thirty-one questions bearing on the type of structure, equipment, and ownership—will be obtained for each of the approximately 35,000,000 dwellings throughout the country.

Housing experts point out that the information gathered will be of inestimable value in the determination of future housing policies. It will be of especial interest to manufacturers, builders, distributors and bankers in their study of trends in home ownership and building in the United States. Census authorities explain that through their tabulations it will be possible to determine facts of vital importance to local geographical and political subdivisions. For example, cities will be able to determine the distribution of the various types of housing within their limits, together with the possible need of expansion of transportation and communication systems, police and fire protection, schools, and similar facilities.

The tables will also help social workers to establish relationships between certain types of housing and human needs by correlating their own data on characteristics and locations of clients with the census information on characteristics of the homes.

Data showing the equipment in homes, together with the state of repair of the homes, will be of value to manufacturers and distributors of housing products in the planning of their sales campaigns.

Home finance institutions will find the average amount of mortgage and the data on mortgages of value in proving and checking the soundness of their investments and the possibility of mortgage expansion.

The aid of trade associations, financial groups and research organizations was obtained by Census officials in the preparation of the questions. In this manner the authorities feel they have arrived at a group of questions which will gather the greatest possible amount of useful information.

The Housing Census will be made at the same time as the balance of the Decennial Census and will be made by the same workers. Authority for the housing census was voted by Congress at its last session. Action on the appropriation has been deferred until the 1940 session.

• OPEN FORUM •

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

48—One of our correspondents presented the following problem. We hope that some of our readers will be able to give the necessary information.

"Our black shades and some of the very dark blue, after dyeing are given a treatment we call 'painting,' which consists of running the cloth over a knurled roller, the roller turning in a bath of the pigment solution with the surplus being scraped off with a doctor blade. The solution consists of ground Prussian Blue with turpentine and linseed oil, the proportions being on the average about six pounds of Prussian Blue, ten pounds of turpentine and 100 pounds of linseed oil.

"The amount picked from the roller by the cloth is then thoroughly brushed into the cloth, after which the cloth has to be cured or 'stoved.' This consists of hanging the cloth in festoons in large chambers which are then closed and heated to approximately 250° F. The cloth must stay in these chambers a minimum of twelve hours, and in some cases where the 'painting' solution is somewhat heavier than average, twenty-four hours is required for proper drying and oxidation.

"We know that there are mechanical dryers on the market which will give better heat and considerably better circulation than we now have in our stoves thereby shortening the curing time considerably, but we believe the better solution is from some chemical means of quicker drying through oxidizing materials."—**L. B. B.**

• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

WANTED: Salesmen wanted for New York, New Jersey, Pa., New England and South for Dyes, Oils and Textile Specialties. Must have contacts, sales ability and technical knowledge. Write giving particulars. Box No. 228, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: Opening for young, single, chemist with at least two years' laboratory experience in the analysis of oils, fats, soaps. Must have minimum of Bachelor's Degree, Protestant. Location central Atlantic State with small rapidly growing company. Give full particulars of experience, education, and salary required, enclose snapshot in application. Write Box No. 226, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

Use Classified Ads for Results